

WOTTON.
REFLECTIONS
UPON
LEARNING

1694







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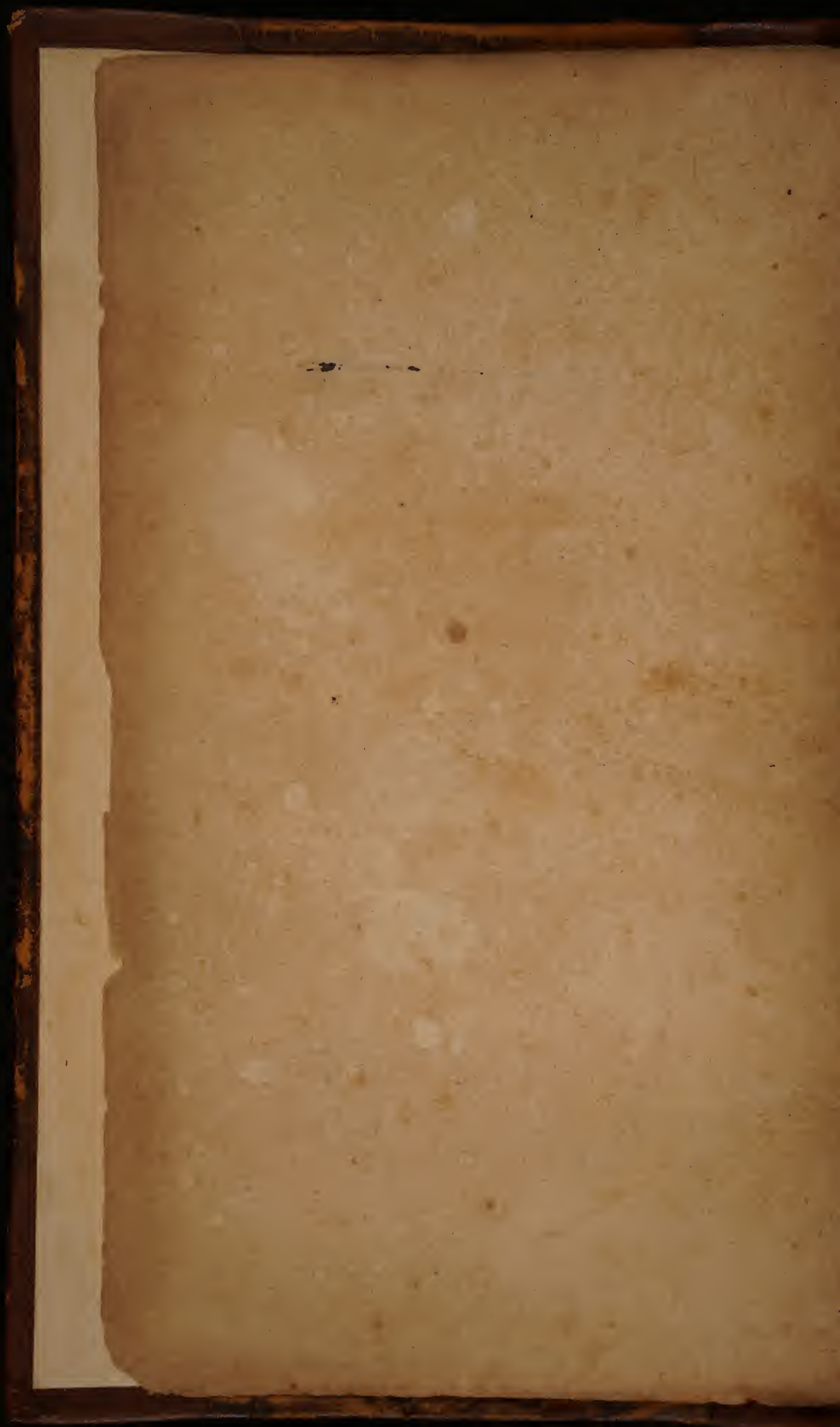
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REFLECTIONS

U P O N

Ancient and Modern

LEARNING.

By *WILLIAM WOTTON*, B. D.

Chaplain to the Right Honourable the
LIBRARY of *NOTTINGHAM*.



L O N D O N,

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306631

TO THE
Right Honourable
DANIEL
Earl of NOTTINGHAM,
Baron FINCH of DAVENTRY.

May it please Your Lordship,

S Ince I am, upon many
Accounts, obliged to
lay the Studies and
Labours of my Life at
Your Lordship's Feet, it will
not, I hope, be thought Pre-
sumption in me to make this
following Address, which, on
my Part, is an Act of Duty.

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I could

The Epistle

I could not omit so fair an Opportunity of declaring how sensible I am of the Honour of being under Your Lordship's Patronage. The Pleasure of telling the World that one is raised by Men who are truly Great and Good, works too powerfully to be smothered in the Breast of him that feels it; especially since a Man is rarely censured for shewing it, but is rather commended for gratifying such an Inclination, when he thankfully publishes to whom he is indebted for all the Comforts and Felicities of his Life.

But Your Lordship has another Right to these Papers, which is equal to that of their being

Dedicatory.

being mine : The Matter it self directs me to Your Lordship as the proper Patron of the Cause, as well as of its Advocate. Those that enquire whether there is such a Spirit now in the World as animated the greatest Examples of Antiquity, must seek for living Instances, as well as abstracted Arguments ; and those they must take care to produce to the best Advantage, if they expect to convince the World that they have found what they sought for.

This therefore being the Subject of this following Enquiry, it seemed necessary to urge the strongest Arguments

The Epistle

first, and to prepossess the World in favour of my Cause, by this Dedication. For those that consider that the Vertues which make up a great Character, such as Magnanimity, Capacity for the highest Employments, Depth of Judgment, Sagacity, Elocution, and Fidelity, are united in as eminent a Degree in Your Lordship, as they are found asunder in the true Characters of the Ancient Worthies; that all this is rendred yet more Illustrious by Your Exemplary Piety and Concern for the Church of England, and Your Zeal for the Rights and Honour of the English Monarchy; and
last

Dedicatory.

last of all, that these Vertues do so constantly descend from Father to Son in Your Lordship's Family, that its Collateral Branches are esteemed Publick Blessings to their Age and Country; will readily confess that the World does still improve, and will go no further than Your Lordship, to silence all that shall be so hardy as to dispute it.

Justice therefore, as well as Gratitude, oblige me to present these Papers to Your Lordship: Though, since I have taken the Freedom, in several Particulars, to dissent from a Gentleman, whose Writings have been very kindly received

The Epistle, &c.

*in the World, I am bound to
declare, that the chief Reason
of this Address was, to let the
World see, that I have a Right
to subscribe my self,*

May it please Your Lordship,

Your Lordship's

Most Obliged,

And Most Dutiful

Servant and Chaplain,

WILLIAM WOTTON.

PREFACE.

THE Argument of these following Papers seems, in a great Measure, to be so very remote from that holy Profession, and from those Studies, to which I am, in a more particular Manner, obliged to dedicate myself, that it may, perhaps, be expected that I should give some Account of the Reasons which engaged me to set about it.

In the first Place therefore, I imagined, that if the several Boundaries of *Ancient and Modern Learning* were once impartially stated, Men would better know what were still unfinished, and what were, in a manner, perfect; and consequently, what deserved the greatest Application, upon the Score of its being

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being imperfect : Which might be a good Inducement to set those Men, who, having a great Genius, find also in themselves an Inclination to promote Learning, upon Subjects wherein they might, probably, meet with Success answerable to their Endeavours : By which Means, Knowledge, in all its Parts, might at last be completed. I believed likewise, that this might insensibly lead Men to follow such, and only such, for their Guides, as they could confide in for the ablest and best in those several Kinds of Learning to which they intended to apply their Thoughts. He that believes the *Ancient Greeks and Romans* to have been the greatest Masters of *the Art of Writing* that have ever yet appeared, will read them as his Instructors, will copy after them, will strive to imitate their Beauties, and form his Stile after their Models,

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Models, if he proposes to himself to be excellent in that Art himself: All which Things will be neglected, and he will content himself to read them in their Translations, to furnish his Mind with Topicks of Discourse, and to have a general Notion of what these Ancient Authors say, if he thinks he may be equally excellent a nearer Way. To read *Greek* and *Latin* with Ease, is a Thing not soon learnt: The Languages are too much out of the common Road; and the Turn which the *Greeks* and *Latins* gave to all their Thoughts, cannot be resembled by what we ordinarily meet with in Modern Languages; which makes them tedious, till mastered by Use. So that constant Reading of the most perfect Modern Books, which does not go jointly on with the Ancients, in their Turns, will, by bringing the Ancients into Dis-use, cause the Learning

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Learning of the next Generation to sink ; by reason that they, not drawing from those Springs from whence these excellent Moderns drew, whom they only propose to follow, nor taking those Measures which these Men took, must, for want of that Foundation which these their Modern Guides first carefully laid, fail in no long Compass of Time.

Yet, on the other Hand, if Men who are unacquainted with these Things, should find every Thing to be commended because it is *oldest*, not because it is *best* ; and afterwards should perceive that in many material and very curious Parts of Learning, the Ancients were, comparatively speaking, grossly ignorant, it would make them suspect that in all other Things also they were equally deficient ; grounding their general Conclusion upon this very common, though erroneous, Principle,

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Principle, that because a Man is in an Errour in those Things whereof we can judge, therefore he must be equally mistaken in those Things where we cannot. Now, this Extream can be no Way more easily avoided, than by stating the due Limits of Ancient and Modern Learning; and shewing, in every Particular, to which we ought to give the Pre-eminence.

But I had another, and a more powerful Reason, to move me to consider this Subject; and that was, that I did believe it might be some way subservient to Religion it self. Among all the Hypotheses of those who would destroy our most holy Faith, none is so plausible as that of the *Eternity of the World*. The fabulous Histories of the *Egyptians*, *Chaldeans* and *Chineses* seem to countenance that Assertion. The seeming Easiness of solving all Difficulties that occur, by pretending that

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that sweeping Floods, or general and successive Invasions of Barbarous Enemies, may have, by Turns, destroyed all the Records of the World, till within these last Five or Six Thousand Years, makes it very amiable to those whose Interest it is, that the *Christian Religion* should be but an empty Form of Words, and yet cannot swallow the *Epicurean* Whimfies of Chance and Accident. Now the Notion of the Eternity of Mankind, through infinite successive Generations of Men, cannot be at once more effectually and more popularly confuted, than by shewing how the World has gone on, from Age to Age, improving; and consequently, that it is at present much more knowing than it ever was since the earliest Times to which History can carry us.

But upon Examination of this Question, several Difficulties appeared,

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peared, which were carefully to be removed. The greatest was, That some Sciences and Arts, of a very compounded Nature, seem really to have been more perfect anciently than they are at present; which did, as it were, directly overthrow my Position. Therefore I was obliged, first, to enquire whether the Thing were true in Fact, or not: Next, If true, whether it proceeded from a particular Force of Genius, or from the Concurrence of some accidental Circumstances; and also, whether, in Case such Circumstances did concur, in other Things, where those Accidents could have no Place, the Moderns did not out-do the Ancients so much, as, allowing the World to be no older than the *Mosaical* Account, it was reasonably to be expected that they should. For then, if all these Questions could be satisfactorily resolved, the Objection would

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would be no Objection at all ; and Mankind might still be supposed to improve, even though in some Particulars they should go back, and fall short of the Perfection which once they had.

There is no Question but these Excellencies of the Ancients might be accounted for, without hurting the Account given by *Moses*, by resolving them into a particular Force of Genius, evidently discernable in former Ages, but extinct long since. But this seemed to be of very ill Consequence, since it did, as it were, suppose that Nature were now worn out, and spent ; and so might tempt a *Libertine* to think that Men, like Mushrooms, sprung out of the Earth when it was fresh and vigorous, impregnated with proper Seminal Atoms, now, of many Ages, no longer seen.

When nothing therefore seemed so likely to take off the Force of
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the main Objection, as the finding of particular Circumstances which might suit with those Ages that did exceed ours, and with those Things wherein they did exceed them, and with no other Age nor Thing besides; I did at last please my self, that I had found these Circumstances; and in setting them down, I took Care, neither to be deceived my self, nor (as I hope) to deceive any Body else.

But what shall be said to those numerous Deluges, which, no Body knows how many Ages before that of *Noah*, or before one another, are said to have carried away all Mankind, except here and there a Couple of ignorant Salvages, who got to some high Mountain, and from thence afterwards replenished the Earth? This Hypothesis (as these Men call it) is so very precarious, that there needs nothing to be replied, but only that it is as
a easily

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easily dis-proved by denying, as affirmed by asserting, since no Records nor Traditions of the Memory of the Facts are pretended ; and something easier, because it may be demonstrably proved, that a general Flood cannot be effected without a Miracle. Now, partial Deluges are not sufficient : If one Country be destroyed, another is preserved ; and if the People of that Country have Learning among them, they will also have a Tradition, that it once was in the other Countries too, which are now dis-peopled.

Upwards of the Age of *Hippocrates*, Knowledge may be traced to its several Sources : But of any great Matters done before *Moses*, there are no sort of Foot-steps remaining, which do not, by their Contradictions, betray their Falshood ; setting those aside which *Moses* himself has preserved. There is Reason to suppose that Invasions of Barbarous Enemies

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Enemies were anciently of the same Nature, as they have been since ; that is, they might possibly make entire Conquests of the Countries which were so invaded ; but we cannot suppose that any of these pretended *Ante-Mosaical* Conquests, of which we are now speaking, made a greater Alteration than that which the *Goths* and *Vandals* made in the *Roman* Empire ; that which the *Saracens* first, and the *Turks* afterwards made in the *Greek* ; or that of the *Tartars* in *China*. The *Goths* and *Vandals* had no Learning of their own ; and if we consider Politeness of Manners, and nothing else, they seem truly to have deserved the Name of *Barbarous* : They therefore took some of the *Roman* Learning, as much as they thought was for their Turn, the Memory whereof can never be said to have been quite extinct during the whole Course of those ignorant

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Ages, which succeeded, and were the Effects of their Conquests. The *Saxons* in *England*, being taught by the *British* Refugees, who planted themselves in *Ireland*, and from thence, by the Way of *Scotland*, came by degrees back again into their own Country, had as much, if not more Learning than any of their *European* Neighbours. The *Saracens* applied themselves to Learning in earnest, as soon as the Rage of their first Wars was over; and resolving to make theirs a compleat Conquest, robbed the *Greeks* of their Knowledge as soon as they had possessed themselves of the most valuable Parts of their Empire. The *Turks* learnt enough, not to be thought illiterate, though less proportionably than any of the fore-mentioned Conquerors: They can write and read; they preserve some rude Annals of their own Exploits, and general Memorials, it matters not

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not how imperfect, of precedent Times : And they lose none of the Mechanical Arts which they found in the Countries where they came, since they either work themselves, or employ others that shall ; which, to the present Purpose, is all a case. The *Tartars* have, since their Conquest, incorporated themselves with the *Chineses*, and are now become one People, only preserving the Authority still in their own Hands.

In all these Instances one may observe, that how barbarous soever these several Conquerors were when first they came into a Civilized Country, they, in Time, learnt so much at least of the Arts and Sciences of the People whom they had subdued, as served them for the necessary Uses of Life ; and thought it not beneath them to be instructed by those to whom they gave Laws. Wherefore there is Reason to believe, that since Mankind has always been of

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the same Make, former Conquests would have produced the same Effects, as we see later ones have done. In short, We cannot say that ever any one Invention of Universal Use has been laid aside, unless some other of greater, and more general Use has come in the Room of it, or the Conquerors took it away, for some Political Reason, either letting it totally die, or supplying it with something else, which to them seemed a valuable Equivalent. Have any of these Conquerors, since *Tubal-Cain's* Time, once suffered the Use of Metals, Iron for Instance, or Gold, to be lost in the World? Have Letters been ever lost, since the Time of that first *Cadmus*, whoever he was, that found them out? Or was Mankind ever put to the Trouble of inventing them a second Time? Have the Arts of Planting, of Weaving, or of Building, been at
any

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any Time intermitted? Does any Man believe that the Use of the *Load-Stone* will ever be forgotten? Are the *Turks* so barbarous, or so spiteful to themselves, that they will not use Gun-powder, because it was taught them by *Christians*? Does not *Garcilasso de la Vega* inform us, that the *Peruvians* would have worshipped the *Spaniards* as Gods, if their Cruelties had not soon led these harmless People to take them to be something else, because they taught them the Use of *Iron* and *Looking-Glasses*? (Whence we may be sure that this innocent and honest Nation never had Learning amongst them before.) Do not we find that they and the *Mexicans*, in a Compass of Four or Five Hundred Years, which is the utmost Period of the Duration of either of their Empires, went on still improving? As the whole *New World* would, probably,

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have done in not many Ages, if these two mighty Nations had extended their Conquests, or if new Empires had arisen, even though the *Spaniards* had never come among them; since those two Empires of *Mexico* and *Pern*, which were the only considerable Civilized Governments in *America*, got constant Ground of their Enemies; having the same Advantages over them, as formed Troops have over a loose Militia. Or can we think that they would again have relapsed to their old Barbarity of themselves, when once they had been weary of those Arts, and of that Learning (such as it was) which then they had? Mankind is not so stupid a Thing, but if they do at any Time find out what may do them great and eminent Service, they will learn it, and make use of it, without enquiring who it is they learn it of, or taking a Prejudice at the Thing, because, perhaps, they may

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may be indebted to an Enemy for it. *Barbarous* and *Polite* are Words which rather referr to Matters of *Breeding* and *Elegance*, than of *Sound Judgment*, or *Common Sense* ; which first shew themselves in making Provision for Things of Convenience, and evident Interest, wherein Men scarce ever commit palpable Mistakes. So that it seems unaccountable that the History of Learning and Arts should be of so confessedly late a Date, if the Things themselves had been very many Ages older ; much more if the World had been Eternal.

Besides these, I had a Third Reason to engage me to this Undertaking ; which was, the Pleasure and Usefulness of those Studies to which it necessarily led me : For Discoveries are most talked of in the Mechanical Philosophy, which has been but lately revived in the World. Its Professors had drawn in to it the whole Knowledge of Nature, which,
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in an Age wherein Natural Religion is denied by many, and Revealed Religion by very many more, seemed highly important to be so far known at least, as that the Invisible Things of the Godhead may be clearly proved by the Things that are seen in the World. Wherefore I thought it might be Labour exceeding well spent, if, whilst I enquired into what was anciently known, and what is a new Discovery, I should at the same Time furnish my Mind with new Occasions of admiring the boundless Wisdom and Bounty of that Almighty and Beneficent Essence, in and by whom alone this whole Universe, with all its Parts, live, and move, and have their Being.

I had also a fresh Inducement to this Search, when I found to how excellent purpose my most learned and worthy Friend, Mr. *Bentley*, has, in his late Discourses
against

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against *Atheism*, shewn what admirable Use may be made of an accurate Search into Nature, thereby to lead us directly up to its Author, so as to leave the unbelieving World without Excuse.

But, after all that I have alledged for my self, I must acknowledge, that I soon found that I did not enough consider *Quid valeant humeri, aut quid ferre recusent*. The Subject was too vast for any one Man, much more for me, to think to do it Justice ; and therefore, as soon as I had drawn up a rude Scheme of the Work, I intended to have given it over, if the importunate Sollicitations of my very ingenious Friend, *Anthony Hammond, Esq;* had not at last prevailed upon me to try what might be said upon it : And it was so difficult a Thing to me to refuse what was so earnestly pressed by a Person who was so very dear to me, and which in the present Case was a
great

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great deal more ; one, for whose Sence and Judgment, all that know him have to very particular a Regard, that I resolved at last, rather to hazard my own Reputation, than to deny his Request ; especially, since I hoped that it might, perhaps, give some Body else an Opportunity to compleat that, of which this Treatise is a very imperfect Essay.

I hope I need make no Apology, that a great Part of this Discourse may seem too Polemical for a Writing of this kind : But that could not be avoided, because the Argument it self has been so much debated. The ablest Men of the two opposite Parties are, Sir *William Temple*, and Monsieur *Perrault* : They are too great Men, and their Writings are too well known, and too much valued, to be over-looked. They cloath their Thoughts in so engaging a Dress, that a Man is tempted to receive all they say, without

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without Examination ; and therefore I was afraid that I might have been accused of betraying my Cause, if, whilst I endeavoured to act the Part of a Mediator, and to give to every Side its just due, I had omitted what these two elegant Advocates had severally alledged for their respective Hypotheses.

What Censure the World will pass upon my Performance, I know not ; only I am willing to think that those who shall not agree to what I say, will grant that I have represented the Opinions of other Men with Impartiality and Candour, and that I have not discovered any Bigottry or Inclination to any one particular Side ; which will be a good Step to make them believe, that I shall not obstinately defend any one Position, which may hereafter be proved to be erroneous.

June 11.

1694.

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ADVERTISEMENT.

THE Reader is desired to take Notice, that the Second Edition of Sir William Temple's *Essay* is quoted every where in this Book; but that all the Citations are also to be found in the Third Edition, which was Corrected and Enlarged by the Author.

ERRATA.

P. Ag. 90. lin. 5. r. *Accounts*. p. 94. 95. r. *Van Dalen*. p. 122. l. 5. r. *exure*. p. 145. l. ult. for *Mechanicks*, r. *Mathematics*. p. 146. l. 3. r. *Verbiest*. p. 164. l. 26. r. *Van Heuraet*. p. 176. l. 24. r. *Limb*. p. 280. l. 22. r. *Ellipse*. p. 271. l. 3. r. *could*. p. 312. l. 2. r. *when we*. p. 314. l. 26. for *Letter*, r. *Discourse*. p. 315. l. 13. for *it is*, r. *they are*.

REFLE

REFLECTIONS

UPON

Ancient and Modern

LEARNING

EDINBURGH SOCIETY

CHAP. I.

*General Reflections upon the State of
the Question.*

THE present State of the Designs and Studies of Mankind is so very different from what it was 150 Years ago, that it is no Wonder if Men's Notions concerning them vary as much as the Things themselves. This great Difference arises from the Desire which every Man has, who believes that he can do greater Things than his Neighbours, of letting them see how much he does excel them: This will oblige him to omit no Opportunity that offers it self to do it, and afterwards to
B express

express his Satisfaction that he has done it. This is not only visible in particular Persons, but in the several Ages of Mankind, which are only Communities of particular Persons, living at the same time, as often as their Humours, or their Interests, lead them to pursue the same Methods. This Emulation equally shews it self, whatsoever the Subject be, about which it is employed; whether it be about Matters of Trade, or War, or Learning, it is all one: One Nation will strive to out-do another, and so will one Age too, when several Nations agree in the pursuit of the same Design; only the Jealousie is not so great in the Contest for Learning, as it is in that for Riches and Power; because these are Things which every several People strive to ingross all to themselves, so that it is impossible for bordering Nations to suffer with any Patience that their Neighbours should grow as great as they in either of them, to their own prejudice; though they will all agree in raising the Credit of the Age they live in upon that Account, that being the only Thing wherein their Interests do perfectly unite.

If this Way of Reasoning will hold, it may be asked how it comes to pass, that the Learned Men of the last Age did not pretend

pretend that they out-did the Ancients, as well as some do now? They would, without question, could they have had any Colour for it: It was the Work of one Age to remove the Rubbish, and to clear the Way for future Inventors. Men seldom strive for Mastery, where the Superiority is not in some sort disputable; then it is that they begin to strive; accordingly, as soon as there was a fair Pretence for such a Dispute, there were not wanting those who soon made the most of it, both by exalting their own Performances, and disparaging every Thing that had been done of that kind by their Predecessors: 'Till the new Philosophy had gotten Ground in the World, this was done very sparingly; which is but within the Compass of 40 or 50 Years. There were but few before, who would be thought to have exceeded the Ancients, unless it were some few Physicians, who set up Chymical Methods of Practice, and Theories of Diseases, founded upon Chymical Notions, in opposition to the *Galenical*: But these Men, for want of conversing much out of their own Laboratories, were unable to maintain their Cause to the general Conviction of Mankind: The Credit of the Cures which they wrought, not supporting them e-

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nough against the Reasonings of their Adversaries.

Soon after the Restauration of King *Charles II.* upon the Institution of the *Royal Society*, the Comparative Excellency of the Old and New Philosophy was eagerly debated in *England*. But the Disputes then managed between *Stubbe* and *Glanvile*, were rather Personal, relating to the Royal Society, than General, relating to Knowledge in its utmost extent. In *France* this Controversie has been taken up more at large: The *French* were not satisfied to argue the Point in Philosophy and Mathematicks, but even in Poetry and Oratory too; where the Ancients had the general Prejudice of the Learned on their Side. Monsieur *de Fontenelle*, the celebrated Author of a Book concerning the *Plurality of Worlds*, begun the Dispute about six Years ago, in a little Discourse annexed to his *Pastorals*. He is something shy in declaring his Mind; at least, in arraigning the Ancients, whose Reputations were already established; though it is plain he would be understood to give the Moderns the Preference in Poetry and Oratory, as well as in Philosophy and Mathematicks. His Book being received with great Applause, it was opposed in *England* by Sir *William Temple*, who, in the

Second

Second Part of his *Miscellanea*, has printed an Essay upon this very Subject. Had Monsieur de Fontenelle's Discourse passed unquestioned, it would have been very strange, since there never was a new Notion started in the World, but some were found, who did as eagerly contradict it.

The Opinion which Sir *William Temple* appears for, is received by so great a Number of Learned Men, that those who oppose it ought to bring much more than a positive Affirmation; otherwise, they cannot expect that the World should give Judgment in their Favour. The Question now to be asked, has formerly been enquired into by few, besides those who have chiefly valued Oratory, Poesie, and all that which the *French* call the *Belles Lettres*; that is to say, all those Arts of Eloquence, wherein the Ancients are generally agreed to have been very excellent. So that Monsieur de Fontenelle took the wrong Course to have his Paradox be believed; for he asserts all, and proves little; he makes no Induction of Particulars, and rarely enters into the Merits of the Cause: He declares that he thinks Love of Ease to be the reigning Principle amongst Mankind; for which Reason perhaps he was loath to put himself to

the trouble of being too minute. It was no wonder therefore if those to whom his Proposition appeared entirely new, condemned him of *Sufficiency, the worst Composition out of the Pride and Ignorance of Mankind.*

However, since his Reasonings are, generally speaking, very just, especially where he discourses of the Comparative Force of the Genius's of Men in the several Ages of the World, I resolved to make some Enquiry into the Particulars of those Things which are asserted by some to be Modern Discoveries, and vindicated to the Ancients by others.

The General Proposition which Sir *William Temple* endeavours to prove in this Essay, is this, "That if we reflect
 " upon the Advantages which the an-
 " cient *Greeks* and *Romans* had, to im-
 " prove themselves in Arts and Sciences,
 " above what the Moderns can pretend
 " to ; and upon that natural Force of Ge-
 " nius, so discernable in the earliest Wri-
 " ters, whose Books are still extant, which
 " has not been equalled in any Persons
 " that have set up for Promoters of Know-
 " ledge in these latter Ages, and com-
 " pare the Actual Performances of them
 " both together, we ought in Justice to
 " conclude, that the Learning of the pre-
 " sent

“sent Age, is only a faint, imperfect
“Copy from the Knowledge of former
“Times, such as could be taken from
“those scattered Fragments which were
“saved out of the general Shipwreck.

The Question that arises from this Proposition will be fully understood, if we enquire, (1.) Into those Things which the Ancients may have been supposed to bring to Perfection, (in case they did so) not because they excelled those that came after them in Understanding, but because they got the Start by being born first. (2.) Whether there are any Arts or Sciences which were more perfectly practised by the Ancients, though all imaginable Care hath been since used to equal them. (3.) Whether there may not be others wherein they are exceeded by the Moderns, though we may reasonably suppose that both Sides did as well as they could.

When such Enquiries have once been made, it will be no hard matter to draw such Inferences afterwards, as will enable us to do Justice to both Sides.

It must be owned, that these Enquiries do not immediately resolve the Question which Sir *William Temple* put, for he confounds two very different Things together; namely, *Who were the Greatest Men, the Ancients, or the Moderns?* and,

Who have carried their Enquiries furthest?
 The first is a very proper Question for a Declamation, though not so proper for a Discourse, wherein Men are supposed to reason severely, because, for want of Mediums whereon to found an Argument, it cannot easily be decided: For, though there be no surer Way of judging of the Comparative Force of the Genius's of several Men, than by examining the respective Beauty or Subtilty of their Performances; yet the good Fortune of appearing first, added to the Misfortune of wanting a Guide, gives the first Comers so great an Advantage, that though, for instance, the *Fairy Queen*, or *Paradise Lost*, may be thought by some to be better Poems than the *Ilias*; yet the same Persons will not say but that *Homer* was a greater Genius than either *Spencer* or *Milton*. And besides, when Men judge of the Greatness of an Inventor's Genius barely by the Subtilty and Curiosity of his Inventions, they may be very liable to Mistakes in their Judgments, unless they knew, and were able to judge of the Easiness or Difficulty of those Methods, or Ratiocinations, by which these Men arrived at, and perfected these their Inventions; which, with due Allowances, is equally applicable to any Performances

Ancient and Modern Learning.

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performances in Matters of Learning of any sort.

It will however be some Satisfaction to those who are concerned for the Glory of the Age in which they live, if, in the first place, it can be proved, That as there are some parts of real and useful Knowledge, wherein not only great Strictness of Reasoning, but Force and Extent of Thought is required thoroughly to comprehend what is already invented, much more to make any considerable Improvements, so that there can be no Dispute of the Strength of such Men's Understandings, who are able to make such Improvements; so in those very Things, such, and so great Discoveries have been made, as will oblige impartial Judges to acknowledge, that there is no probability that the World decays in Vigour and Strength, if (according to Sir *William Temple's* Hypothesis) we take our Estimate from the Measure of those Men's Parts, who have made these Advancements in these later Years; especially, if it should be found that the Ancients took a great deal of pains upon these very Subjects, and had able Masters to instruct them at their first setting out: And Secondly, If it should be proved, that there are other curious and useful Parts of Knowledge, wherein the Ancients

cients had equal Opportunities of advancing and pursuing their Enquiries, with as much Facility as the Moderns, which were either slightly passed over, or wholly neglected, if we set the Labours of some few Men aside: And Lastly, If it should be proved, that by some great and happy Inventions, wholly unknown to former Ages, new and spacious Fields of Knowledge have been discovered, and, pursuant to those Discoveries, have been viewed, and searched into, with all the Care and Exactness which such noble Theories required. If these Three Things should be done, both Questions would be at once resolved, and Sir *William Temple* would see that the Moderns have done something more than Copy from their Teachers, and that there is no absolute necessity of making all those melancholy

(a) Pag. 5. Reflections upon (a) *the Sufficiency and Ignorance of the present Age*, which he, moved with a just Resentment and Indignation, has thought fit to bestow upon them.
55, 56.

How far these Things can, or cannot be proved, shall be my Business in these following Papers to enquire. But First, Of those Things wherein, if the Ancients have so far excelled as to bring them to Perfection, it may be thought that they did it because they were born before us.

CHAP.

CHAP. II.

*Of the Moral and Political Knowledge
of the Ancients and Moderns.*

I Have often thought that there could not be a pleasanter Entertainment to an inquisitive Man, than to run over the first Thoughts which he had in his Infancy, whilst he was gathering his Collection of *Idea's*, and labouring to express those Sounds, by which he perceived that his Mother and Nurse made themselves be understood. We should then see the true Gradations by which Knowledge is acquired: We should judge, perhaps, what is in it self hard, and what easie, and also what it is that makes them so; and thereby make a better Estimate of the Force of Men's Understandings, than can now be made. But this it is in vain to lament for, since it can never be had. Yet it may in general be observed, that the first Thoughts of Infants are of Things immediately necessary for Life. That being in some measure satisfied, they spend their Childhood in Pleasure, if left to their own Liberty, till they are grown up. Then they begin to reflect upon the Things
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that relate to Prudence and Discretion, and that more or less, according as their Circumstances oblige them to carry themselves more or less warily towards those with whom they converse. This is, and ever was, general to all Mankind; whereas they would not take so much pains to cultivate the Arts of Luxury and Magnificence, if they were not spurred on by Pride, and a Desire of not being behind other Men. So that it is reasonable to suppose, that, all those Things which relate to Moral Knowledge, taken in its largest Extent, were understood by the ancient *Egyptians, Greeks and Romans*, in as great Perfection as the Things themselves were capable of. The Arts of Governing of Kingdoms and Families; of Managing the Affections and Fears of the unconstant Multitude; of Ruling their Passions, and Discoursing concerning their several Ways of Working; of Making prudent Laws, and Laying down wise Methods by which they might be the more easily and effectually obeyed; of Conversing each with other; of Giving and Paying all that Respect which is due to Men's several Qualities: In short, all that is commonly meant by knowing the World, and understanding Mankind; all Things necessary to make Men wise
in

in Counsel, dexterous in Business, and agreeable in Conversation, seem to have been in former Ages thoroughly understood, and successfully practised.

There seems, indeed, to be some Reason to fear, that in the Arts of Knavery and Deceit, the present Age may have refined upon the foregoing; but that is so little for its Honour, that common Decency does almost as much oblige me to throw a Veil over this Reproach, as common Interest does all Mankind to put an effectual Stop to its Increase. But since we are enquiring into Excellencies, not Blemishes and Imperfections, there seems to be great Reason to affirm, that After-Ages had no need to invent Rules, which already were laid down to their Hands; but that their Business was chiefly to re-examine them, and to see which were proper for their Circumstances, considering what Alterations Time sensibly introduces into the Customs of every Age; and then to make a wise Choice of what they borrowed, that so their Judgment might not be questioned by those who should have the Curiosity to compare the Wisdom of several Ages together.

If we descend into Particulars, these Observations will, I believe, be found to be very true: The minutest Differences between
Vertue

Vertue and Vice of all sorts, are judiciously stated by *Aristotle*, in his *Ethicks* to *Nicomachus*. *Xenophon's Cyrus* shews that he had a right Notion of all those Things which will make a Prince truly great and wise. The Characters of all those Vices which are immediately taken notice of in Civil Life, are admirably drawn by *Theophrastus*. Nothing can give a clearer Idea of one that has lived under Tyrants, than the Writings of *Tacitus*; in whose Histories, almost every Thing is told in such a Way, as we see that Ill Usage and Disappointments lead Men to censure and report the Actions of former Governors. Great Skill in all the Arts and Secrets of Persuasion appear every where in *Demosthenes* and *Tully's* Orations, in *Quintilian's* Institutions, and the Orations in *Thucydides*, *Sallust* and *Livy*. The Duties of Mankind in Civil Life, are excellently set forth in *Tully's Offices*. Not one Passion of the Soul of Man has been untouched, and that with Life too, by some or other of the Ancient Poets. It would require a Volume to state these Things in their full Light; and it has been done very often by those who have given Characters and Censures of Ancient Authors. So that one may justly conclude, that there is no one Part of Moral Knowledge,
strictly

strictly so called, which was not known by the Ancients, equally well as by the Moderns.

But it would be a wrong Inference to conclude from thence, that the Ancients were greater Genius's than the Men of the present Age. For, by Sir *William Temple's* Confession (*b*), the *Chineses* and *Peruans* were governed by excellent Laws: and *Confucius* and *Mango Capac* may well be reckoned amongst the Law-givers and Philosophers of those which are commonly called learned Nations; though neither of them, especially the Latter, can justly be suspected of learning what they knew by Communication from other Nations. From whence Sir *William Temple* rightly concludes, that Common Sense is of the Growth of every Country; and that all People who unite into Societies, and form Governments, will in time make prudent Laws of all kinds; since it is not Strength of Imagination, nor Subtilty of Reasoning, but Constancy in making Observations upon the several Ways of Working of Humane Nature, that first stored the World with Moral Truths, and put Mankind upon forming such Rules of Practice as best suited with these Observations. There is no Wonder therefore, that in a long Series of
Ages,

(b) *Essay 3. upon Heroick Vertue, Sect. 2, 3.*

Ages, which preceded *Socrates* and *Plato*, these Matters were carried to a great Perfection; for as the Necessity of any Thing is greater, so it will be more and more generally studied: And as the Subject of our Enquiries is nearer to us, or easier to be comprehended in it self; so it will be more thoroughly examined, and what is to be known will be more perfectly understood. Both these concur here: Necessity of conversing with each other put Men upon making numerous Observations upon the Tempers of Mankind: And their own Nature being the Thing enquired after, all Men could make their Experiments at home; which, in Confort with those made with and by other People, enabled them to make certain Conclusions of Eternal Truth, since Mankind varies little, if any thing, any farther than as Customs alter it, from one Age to another. Since therefore this Necessity always lasts, and that all the Observations requisite to compleat this noble Science, as it takes in the Art of Governing Kingdoms, Families, and Men's private Persons, cannot be made by one or two Generations, there is a plain Reason why some Nations, which wanted Opportunities of diffused Conversation, were more barbarous than the rest; and also, why

why others, who for many Ages met with no Foreign Enemies that could overturn their Constitutions, should be capable of improving this part of Knowledge as far as *unassisted Reason* was able to carry it.

For, after all, how weak the Knowledge of the ancient Heathens was, even here, will appear by comparing the Writings of the old Philosophers, with those Moral Rules which *Solomon* left us in the *Old Testament*, and which our Blessed Saviour and his Apostles laid down in the *New*. Rules so well suited to the Reason of Man, so well adapted to civilize the World, and to introduce that true Happiness which the old Philosophers so vainly strove to find, that the more they are considered, the more they will be valued: and accordingly, they have extorted even from those who did not believe the Christian Religion, just Applauses, which were certainly unbiaſſed, because, not being led by the Rewards which it proposes, nor deterred by the Punishments which it threatens, they could have no Motive to commend them but their own native Excellency. So that one may justly wonder why Sir *W. T.* should give us an Account of *Mahomet's* Life, and that so minutely, as not to omit *the Sergian Monk,*

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his

(c) Essay 3. pag. 248.
*He means Sergius, a Monk;
 turning the Name of a Man
 into the Denomination of an
 Order. Sergius is said to
 have been a Nestorian.*

*his Master (c), in his Essay of
 Heroick Vertue; where he
 mentions Law-givers, as well
 as Generals, and yet take no
 notice of Moses and Jesus
 Christ.*

It is evident therefore, that though in some Sence the Moderns may be said to have learned their Politicks and Ethicks from the Ancients, yet there is no convincing Argument that can be brought from those Sciences, singly considered, that the Ancients had a greater Force of Genius than the wise and prudent Men of these later Generations. If, indeed, in all other Sciences, Mankind has for 1500 Years been at a full Stop, the Perfection of the Ancient Politicks and Ethicks may be justly urged, amongst other Arguments, for the comparative Strength of their Parts; otherwise not.

But there are other Parts of Learning, that may seem capable of farther Improvement; of which, the Advocates for the Ancients do not only pretend that they were the Inventors, but that their Performances have never since been equalled, much less out-done; though within these last 200 Years all imaginable Pains have been taken to do it; and great Rewards have been given to those who have,
licet

licet non passibus aequis, laboured to come near the Copies which were already set them. From whence these Men think it probable that all Modern Learning is but Imitation, and that faint and flat, like the Paintings of those who draw after Copies at a Third or Fourth Hand from the Life. Now, as this can only be known by an Induction of Particulars, so of these Particulars there are two sorts: One, of those wherein the greatest part of those Learned Men who have compared Ancient and Modern Performances, either give up the Cause to the Ancients quite, or think, at least, that the Moderns have not gone beyond them. The other of those, where the Advocates for the Moderns think the Case so clear on their Side, that they wonder how any Man can dispute it with them. Poësie, Oratory, Architecture, Painting, and Statuary, are of the First Sort: Natural History, Physiology, and Mathematicks, with all their Dependencies, are of the Second.

C H A P. III.

*Of Ancient and Modern Eloquence
and Poesie.*

IT is acknowledged by most Men, that he who has studied any Subject, is a better Judge of that Subject than another Man who did never purposely bend his Thoughts that way, provided they be both Men of equal Parts. Yet we see there are many Things, whereof Men will, at first sight, pass their Judgment, and obstinately adhere to it, though they not only know nothing of those Matters, but will confess that it requires Parts, and Skill, and Exercise, to be excellent in them. This is remarkably visible in the Censures which are passed upon Pieces of Oratory and Poesie every Day by those who have very little, or none, of that sort of Learning themselves; and to whom all that is said of Skill in those Things, and of a true Relish of what is really fine, is Jargon and Cant. And in the mean time, these Men do in other Things shew great Accuracy and Judgment, even in Subjects which require quick Apprehension, nice Observation, and

and frequent Meditation. If one should ask why such Men so frequently mistake and differ in those other Matters, the Answer, I think is this : (1.) The Foundations of Eloquence of all sorts lying in Common Sense, of which every Man is in some degree a Master, most ingenious Men have, without any Study, a little Insight into these Things. This little Insight betrays them immediately to declare their Opinions, because they are afraid, if they should not, their Reputation would be in danger. On the contrary, where the Subject is such, that every Man finds he can frame no *Idea* of it in his own Mind, without a great number of Premises, which cannot be attained by common Conversation, all wise Men hold their Hands, suspect their own Abilities, and are afraid that they cannot fathom the Depth of his Knowledge with whom they converse ; especially if he has a Name for Skill in those Matters. And therefore, talk with such Men of a Law-Case, or a Problem in Geometry, if they never studied those Things, they will frankly tell you so, and decline to give their Opinion. Whereas if you speak to them of a Poem, a Play, or a Moral Discourse upon a Subject capable of Rhetorical Ornaments, they will immediately

pass their Censure, right or wrong ; and Twenty Men, perhaps, shall give Twenty different Opinions ; whilst, in the other Cases, scarce Two of the Twenty shall disagree, if they are conscious to themselves that they have Skill enough to judge without another's help. (2.) In most of these Things our Passions are some Way or other concerned ; at least, being accustomed to have them moved, we expect it, and think our selves disappointed when our Expectation is deceived. Now, when a Man is to judge in Matters of this kind, he generally beforehand is pre-possessed with such Passions as he would willingly have raised, or confirmed ; and so speaks as his Expectation is answered. But when our Passions do not move in these Matters, as they seldom do upon Subjects a great way off, then our Censures are more unanimous. For, as the Poet says,

*Securus licet Æneam Rutulumq; ferocem
Committas ; nulli gravis est percussus Achilles.*

So that there is no great Wonder why Men should receive the Writings of the Ancients with so great Respect : For the Distance of Time takes off Envy ; and the
being

being accustomed from our Childhood to hear them commended, creates a Reverence. Yet though due Allowances ought to be made for these Pre-possessions, one has Reason to believe, that this Reverence for the Ancient Orators and Poets is more than Prejudice. (By Orators, I understand all those Writers in Prose who took pains to beautifie and adorn their Stile.) Their Works give us a very solid Pleasure when we read them. The best in their kind among the Moderns have been those who have read the Ancients with greatest Care, and endeavoured to imitate them with the greatest Accuracy. The Masters of Writing in all these several Ways, to this Day, appeal to the Ancients, as their Guides; and still fetch Rules from them, for the Art of Writing. *Homer*, and *Aristotle*, and *Virgil*, and *Horace*, and *Ovid*, and *Terence*, are now studied as Teachers, not barely out of Curiosity, by Modern Poets. So likewise are *Demosthenes*, *Aristotle*, *Tully*, *Quintilian*, and *Longinus*, by those who would write finely in Prose. So that there is Reason to think that in these Arts the Ancients may have out-done the Moderns; though neither have they been neglected in these later Ages, in which we have seen extraordinary Productions,

which the Ancients themselves, had they been alive, would not have been ashamed of.

If this be so, as I verily believe it is, sure now (it will be objected) It is evident that the Ancients had a greater Force of Genius than the Moderns can pretend to. Will it be urged, that here also they had an Advantage by being born first? Have these Arts a fixed Foundation in Nature; or were they not attained to by Study? If by Nature, why have we heard of no Orators among the Inhabitants of the Bay of *Soldania*, or eminent Poets in *Pern*? If by Study, why not now, as well as formerly, since Printing has made Learning cheap and easie? Does it seem harder to speak and write like *Cicero* or *Virgil*, than to find out the motions of the Heavens, and to calculate the Distances of the Stars? What can be the Reason of this Disparity?

The Reasons are several, and scarce one of them of such a Nature as can now be helped, and yet not conclusive against the Comparative Strength of Understanding, evidently discernible in the Productions of the Learned Men of the present, and immediately foregoing Ages; to which I would be understood strictly to confine my Notion of the Word *Modern*. These

These Reasons I shall examine at large, because, if they are valid, they quite take away the Force of Sir *William Temple's* Hypothesis; and by removing the blind Admiration now paid to the Ancient Orators and Poets, set it upon such a Foot as will render the Reading of their Books more useful, because less superstitious. They are of several Sorts; some relating to Oratory, some to Poësie, and some in common to both.

I shall first speak of those which relate more particularly to Poetry, because it was much the ancientest Way of Writing in *Greece*; where their Orators owned, that they learned a great deal of what they knew, even in their own, as well as in other Parts of Learning, from their Poets. And here one may observe, that no Poetry can be Charming that has not a Language to support it. The *Greek* Tongue has a vast Variety of long Words, wherein long and short Syllables are agreeably intermixed together, with great Numbers of Vowels and Diphthongs in the Middle-Syllables, and those very seldom clogged by the joyning of harsh-sounding Consonants in the same Syllable: All which Things give it a vast Advantage above any other Language that has ever yet been cultivated by Learned Men.

Men. By this Means all manner of Tunable Numbers may be formed in it with Ease ; as still appears in the remaining *Dramatick* and *Lyrick* Composures of the *Greek* Poets. This seems to have been at first a lucky Accident, since it is as visible in *Homer*, who lived before the Grammarians had determined the Analogy of that Language by Rules ; which Rules were, in a very great measure, taken from his Poems, as the Standard ; as in those Poets that came after him. And that this peculiar Smoothness of the *Greek* Language was at first Accidental, farther appears, because the *Phœnician* or *Hebrew* Tongue, from whence it was formed, as most Learned Men agree, is a rough, unpolished Tongue ; abounding with short Words, and harsh Consonants : So that if one allows for some very small Agreement in the Numbers of Nouns, and Variations of Tenses in Verbs, the two Languages are wholly of a different Make. That a derived Language should be sweeter than its Mother-Tongue, will seem strange to none that compares the Modern *Tuscan* with the Ancient *Latin* ; where, though their Affinity is visible at first Sight, in every Sentence, yet one sees that that derived Language actually has a Sweetness and Tunableness in its
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Composition, that could not be derived from its Parent ; since nothing can impart that to another, which it has not itself : And it shows likewise, that a Barbarous People , as the *Italians* were when mingled with the *Goths* and *Lombards*, may, without knowing or minding Grammatical Analogy, form a Language so very musical, that no Art can mend it. For, in *Boccace's* Time, who lived above 300 Years ago, in the earliest Dawnings of Polite Learning in these Western Parts of the World, *Italian* was a formed Language, endued with that peculiar Smoothness which other *European* Languages wanted ; and it has since suffered no fundamental Alterations ; not any, at least, for the better, since in the *Dictionary* of the Academy *della Crusca*, *Boccace's* Writings are often appealed to in doubtful Cases, which concern the Niceties of the Tongue.

Now, when this Native Smoothness of the *Greek* Tongue was once discovered to common Ears, by the sweetness of their Verses, which depended upon a Regular Composition of Long and Short Syllables, all Men paid great Respect to their Poets, who gave them so delightful an Entertainment. The wiser Sort took this Opportunity of Civilizing the rest, by putting

putting all their Theological and Philosophical Instructions into Verse ; which being learnt with Pleasure, and remembered with Ease, helped to heighten and preserve the Veneration already, upon other Scores, paid to their Poets. This increased the Number of Rivals, and every one striving to out-do his Neighbour ; some by varying their Numbers, others by chusing Subjects likely to please, here and there some, one or two at least of a sort, proved excellent : And then, those who were the most extraordinary in their several Ways, were esteemed as Standards by succeeding Ages ; and Rules were framed by their Works, to examine other Poems of the same sort. Thus *Aristotle* framed Rules of *Epick* Poesie from *Homer* : Thus *Aristophanes*, *Menander*, *Sophocles* and *Euripides* were looked upon as Masters in *Dramatick* Poesie ; and their Practice was sufficient Authority. Thus *Mimnermus*, *Philetas* and *Callimachus* were the Patterns to following Imitators for *Elegy* and *Epigram*. Now, Poetry being a limited Art, and these Men, after the often-repeated Trials of others, had proved successless ; finding the true Secret of pleasing their Country-men, partly by their Wit and Sence, and partly by the inimitable Sweetness of their Numbers, there

there is no Wonder that their Successors, who were to write to a pre-possessed Audience, though otherwise Men of equal, perhaps greater Parts, failed of that Applause of which the great Masters were already in possession; for Copying nauseates more in Poetry, than any thing: So that *Buchanan* and *Sannazarius*, tho' admirable Poets, are not read with that Pleasure which Men find in *Lucretius* and *Virgil*, by any but their Country-men, because they wrote in a dead Language, and so were frequently obliged to use the same Turns of Thought, and always the same Words and Phrases, in the same Sense in which they were used before by the Original Authors; which forces their Readers too often to look back upon their Masters; and so abates of that Pleasure which Men take in *Milton*, *Comley*, *Butler*, or *Dryden*, who wrote in their Mother-Tongue, and so were able to give that unconstrained Range and Turn to their Thoughts and Expressions that are truly necessary to make a compleat Poem.

It may therefore be very reasonably believed, that the natural Softness, Expressiveness and Fulness of the *Greek* Language gave great Encouragement to the *Greek* Poets to labour hard, when they had

had such manageable Matter to work upon, and when such Rewards constantly attended their Labours. This likewise was a great Help to their Orators, as well as their Poets; who soon found the Beauties of a numerous Composition, and left nothing undone, that could bring it to its utmost Perfection. But this was not so important a Consideration, as alone to have encouraged the *Greeks* to cultivate their Eloquence, if the Constitution of their Governments had not made it necessary; and that Necessity had not obliged a very great Number of ingenious Men to take Pains about it.

Most part of *Greece*, properly so called, and of *Asia the Less*, the Coasts of *Thrace*, *Sicily*, the Islands in the *Mediterranean*, and a great part of *Italy*, were long divided into great Numbers of Kingdoms and Commonwealths; and many of these small Kingdoms, taking Example by their neighbouring Cities that had thrown off their imperious Masters, turned, in time, to Commonwealths, as well as they. These, as all little Governments that are contiguous, being well nigh an even Match for each other, continued for many Ages in that Condition. Many of the chiefest were Democracies; as, the Republicks of *Athens*, *Syracuse*, *Thebes* and *Corinth*; where

where it was necessary to complement the People upon all Occasions: So that busie, factious Men had Opportunities enough to shew their Skill in Politicks. Men of all Tempers, and all Designs, that would accuse or defend, that would advise or consult, were obliged to address themselves in set Harangues to the People. Interest therefore, and Vanity, Motives sometimes equally powerful, made the Study of Rhetorick necessary; and whilst every Man followed the several Bias of his own Genius, some few found out the true Secret of Pleasing, in all the several Ways of Speaking well, which are so admirably, and so largely discoursed of by the ancient Rhetoricians. *Demosthenes* being esteemed beyond all his Predecessors, for the Correctness of his Stile, the Justness of his Figures, the Easiness of his Narrations, and the Force of his Thoughts; his Orations were looked upon as Standards of Eloquence by his Country-men: Which Notion of theirs effectually damped future Endeavours of other Men, since here, as well as in Poetry and Painting, all Copiers will ever continue on this side of their Originals. And besides, the great End of Oratory being to persuade, wherein Regard must be had to the Audience, as well as to the Subject, if there be but one

one Way of doing best at the same time in both, as there can be but one in all limited Arts or Sciences, they that either first find it out, or come the nearest to it, will unquestionably, and of Right, keep the first Station in Men's Esteem, though perhaps they dare not, for fear of disgusting the Age they live in, follow those Methods which they admire so much, and so justly, in those great Masters that went before them.

That these Accidents, and not a particular Force of Genius, raised the *Grecian* Poësie and Oratory, will further appear, if we reflect upon the History of the Rise and Increase of both those Arts amongst the *Romans*: Their Learning, as well as their Language, came originally from *Greece*; they saw what was done to their Hands, and *Greek* was a living Language; and so, by the help of Masters, they could judge of all its Beauties. Yet, with all their Care, and Skill, and Pains, they could not, of a long time, bring their Poetry to any Smoothness; they found that their Language was not so ductile, they owned it, and complained of it. It had a Majestick Gravity, derived from the People themselves who spoke it; which made it proper for Philosophical and Epical Poems; for which Reason,

Lucretius

Lucretius and *Virgil* were able to do so great Things in their several Ways, their Language enabling them to give the most becoming Beauties to all their Thoughts. But there not being that Variety of Feet in the *Latin*, which Language, for the most part, abounds in *Dactyles*, *Spondees* and *Trochees*; nor that Sprightliness of Temper, and in-bred Gaiety in the *Romans*, which the *Greeks* are to this Day famous for, even to a Proverb, in many Parts of Poetry they yielded, though not without Reluctancy, to a People whom they themselves had conquered. Which shews, that Natural Imperfections cannot be overcome: And when these Imperfections are accidental, as the Language is which every Man speaks at first, though he has equal Parts, and perhaps greater Industry, yet he shall be thrown behind another Man who does not labour under those Inconveniences; and the Distance between them will be greater, or less, according to the Greatness or Quality of these Inconveniences.

If we bring this Thing down to Modern Languages, we shall find them labouring under much greater: For, the Quantities of Syllables being, in a manner, lost in all Modern Languages, we can have no Notion of that Variety of

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Feet

Feet which was anciently used by the *Greeks* and *Romans*, in Modern Poems. The Guide of Verses is not now Length of Syllable, but only Number of Feet, and Accent: Most of the *French* Accents are in the last Syllable; Ours, and the *Italian*, in the fore-going. This fits *French* for some sorts of Poems, which *Italian* and *English* are not so proper for. Again, All Syllables, except the Accented one in each Word, being now common in Modern Languages, we Northern People often make a Syllable short that has two or three Consonants in it, because we abound in Consonants: This makes *English* more unfit for some Poems, than *French* and *Italian*; which having fewer Consonants, have consequently a greater Smoothness and Flowingness of Feet, and Rapidity of Pronunciation.

I have brought these Instances out of Modern Languages, whereof Sir *William Temple* is so great a Master, to prove my first Assertion; namely, That though a very great deal is to be given to the Genius and Judgment of the Poet, which are both absolutely necessary to make a good Poem, what Tongue soever the Poet writes in; yet the Language it self has so great an Influence, that if *Homer* and *Virgil* had been *Polanders*, or *High-Dutch*.

Dutch-Men, they would never, in all probability, have thought it worth their while to attempt the Writing of Heroick Poems; *Virgil* especially, (c) who began to write an Historical Poem of some great Actions of his Country-men; but was so gravelled with the Roughness of the *Roman* Names, that he laid it aside.

(c) Cum res Romanas inchoasset, offensus materiâ & nominum asperitate, ad Bucolica transiit. Donatus in Vita Virgilii.

Now, as the *Roman* Poetry arrived to that Perfection which it had, because it was supported by a Language which, though in some Things inferiour to the *Greek*, had noble and charming Beauties, not now to be found in Modern Languages; so the *Roman* Oratory was owing to their Government: Which makes the Parallel much more perfect: And all those Reasons alledged already for the Growth of the *Attick* Eloquence, are equally applicable to the History of the *Roman*; so that there is no Necessity of Repeating them. To which we may add, That when the *Romans* once lost their Liberty, their Eloquence soon fell: And *Tacitus* (or *Quintilian*) needed not have gone so far about to search for Reasons of the Decay of the *Roman* Eloquence. *Tully* left his Country and Profession, after his Defence of *S. Roscius Amerinus*; resolv-

ing to give over Pleading, if *Sylla's* Death had not restored that Freedom which only gave Life to his Oratory : And when the Civil Wars between *Pompey* and *Cæsar* came on, he retired, because his Profession was superseded by a rougher Rhetorick, which commands an Attentive Audience in all Countries where it pleads.

When Orators are no longer Constituent Parts of a Government, or, at least, when Eloquence is not an almost certain Step to arrive at the chiefest Honours in a State, the Necessity of the Art of Speaking is, in a great measure, taken off; and as the Authority of Orators lessens, which it will insensibly do as Tyranny and Absolute Power prevail, their Art will dwindle into Declamation, and an Affectation of Sentences, and Forms of Wit. The Old Men, who out-live their former Splendor, will, perhaps, set their own Scholars and Auditors right, and give them a true Relish of what is Great and Noble; but that will hardly continue above one or two Generations. Which may be super-added as another Reason why there were no more *Demosthenes's* or *Tullies*, after the *Macedonian* and *Roman* Emperors had taken away the Liberty of their respective Commonwealths. It is
Liberty

Liberty alone which inspires Men with Lofty Thoughts, and elevates their Souls to a higher Pitch than Rules of Art can direct. Books of Rhetorick make Men Copious and Methodical ; but they alone can never infuse that true Enthusiastick Rage which Liberty breaths into their Souls who enjoy it : And which, guided by a Sedate Judgment, will carry Men further than the greatest Industry, and the quickest Parts can go without it.

When private Members of a Commonwealth can have Foreign Princes for their Clients, and plead their Causes before their Fellow-Citizens ; when Men have their Understandings enlarged, by a long Use of publick Business, for many Years before they speak in publick ; and when they know that their Auditory are Men, not only of equal Parts, and Experience in Business ; but also many of them Men of equal, if not greater Skill in Rhetorick than themselves : Which was the Case of the old *Romans*. These Men, inflamed with the mighty Honour of being Patrons to Crowned Heads, having Liberty to speak any Thing that may advantage their Cause, and being obliged to take so great Pains to get up to, or to keep above so many Rivals, must needs be much more excellent Orators, than other Ages,

destitute of such concurrent Circumstances, though every thing else be equal, can possibly produce.

Besides all this, the Humour of the Age which we live in is exceedingly altered: Men apprehend or suspect a Trick in every Thing that is said to move the Passions of the Auditory in Courts of Judicature, or in the *Parliament-House*: They think themselves affronted when such Methods are used in Speaking, as if the Orator could suppose within himself, that they were to be caught by such Baits. And therefore, when Men have spoken to the Point, in as few Words as the Matter will bear, it is expected they should hold their Tongues. Even in the Pulpit, the Pomp of Rhetorick is not always commended; and very few meet with Applause, who do not confine themselves to speak with the Severity of a Philosopher, as well as with the Splendour of an Orator; two Things, not always consistent. What a Difference in the Way of Thinking must this needs create in the World? Anciently, Orators made their Employment the Work of their whole Lives; and as such, they followed it: All their Studies, even in other Things, were, by a sort of Alchemy, turned into Eloquence. The Labour which they thought

thought requisite, is evident to any Man that reads *Quintilian's Institutions*, and the Rhetorical Tracts of *Cicero*. This exceedingly takes off the Wonder: Eloquence may lie in common for Ancients and Moderns, yet those only shall be most excellent that cultivate it most, who live in an Age that is accustomed to, and will bear nothing but Masculine, unaffected Sense; which likewise must be cloathed with the most splendid Ornaments of Rhetorick.

Sir *William Temple* will certainly agree with me in this Conclusion, that former Ages made greater Orators, and nobler Poets, than these later Ages have done; though perhaps he may disagree with me about the Way by which I came to my Conclusion; since hence it will follow, that the present Age, with the same Advantages, under the same Circumstances, might produce a *Demosthenes*, a *Cicero*, a *Horace*, or a *Virgil*; which, for any thing hitherto said to the contrary, seems to be very probable.

But, though the Art of Speaking, assisted by all these Advantages, seems to have been at a greater height amongst the *Greeks* and *Romans*, than it is at present, yet it will not follow from thence, that every Thing which is capable of

Rhetorical Ornaments should, for that sole Reason, be more perfect anciently than now ; especially if these be only Secondary Beauties, without which, that Discourse wherein they are found may be justly valuable, and that in a very high Degree. So that, though, for the purpose, one should allow the Ancient Historians to be better Orators than the Modern, yet these last may, for all that, be much better, at least, equally good Historians ; those among them especially, who have taken fitting Care to please the Ears, as well as instruct the Understandings of their Readers. Of all the Ancient Historians before *Polybius*, none seems to have had a right Notion of writing History, except *Thucydides* : And therefore *Polybius*, whose first Aim was, to instruct his Reader by leading him into every Place, whither the Thread of his Narrative carried him, makes frequent Excuses for those Digressions, which were but just necessary to beget a thorough Understanding of the Matter of Fact of which he was then giving an Account. These Excuses show that he took a new Method ; and they answer an Objection, which might otherwise have been raised from the small Numbers of extant Histories that were written before his Time ;

Time ; as if we could make no Judgment of those that are lost, from those that are preserved. For, the Generality of those who wrote before him, made Rhetorick their chief Aim ; and therefore all Niceties of Time, and Place, and Person, that might hurt the Flowingness of their Stile, were omitted ; instead whereof, the Great Men of their *Drama's* were introduced, making long Speeches ; and such a Gloss was put upon every Thing that was told, as made it appear extraordinary ; and Things that were wonderful and prodigious were mentioned with a particular Emphasis.

This Censure will not appear unjust to any Man who has read Ancient Historians with ordinary Care ; *Polybius* especially : Who, first of all the Ancient Historians, fixes the Time of every great Action that he mentions : Who assigns such Reasons for all Events, as seem, even at this distance, neither too great, nor too little : Who, in Military Matters, takes Care, not only to shew his own Skill, but to make his Reader a Judge, as well as himself : Who, in Civil Affairs, makes his Judgment of the Conduct of every People from the several Constitutions of their respective Governments, or from the Characters and Circum-

cumstances of the Actors themselves: And last of all, Who scrupulously avoids saying any Thing that might appear incredible to Posterity; but represents Things in such a manner, as a wise Man may believe they were transacted: And yet he has neglected all that Artful Eloquence which was before so much in fashion.

If these therefore be the chiefest Perfections of a just History, and if they can only be the Effects of a great Genius, and great Study, or both; at least, not of the last, without the first, we are next to enquire whether any of the Moderns have been able to attain to them: And then, if several may be found, which in none of these Excellencies seem to yield to the noblest of all the Ancient Histories, it will not be difficult to give an Answer to Sir *William Temple's* Question; *Whether (d) D'Avila's and Strada's Histories be beyond those of Herodotus and Livy?* I shall name but two; *The Memoirs of Philip Comines*, and *F. Paul's History of the Council of Trent*.

Philip Comines ought here to be mentioned for many Reasons: For, besides that he particularly excels in those very Vertues which are so remarkable in *Polybius*, to whom *Lipsius* makes no Scruple
to

to compare him, he had nothing to help him but Strength of Genius, assisted by Observation and Experience: He owns himself, that he had no Learning; and it is evident to any Man that reads his Writings. He flourished in a barbarous Age, and died just as Learning had crossed the *Alpes*, to get into *France*: So that he could not, by Conversation with Scholars, have those Defects which Learning cures, supplied. This is what cannot be said of the *Thucydides's*, *Polybius's*, *Salusts*, *Livies*, and *Tacitus's* of Antiquity. Yet, with all these Disadvantages, to which this great one ought also to be added, That by the Monkish Books then in vogue, he might sooner be led out of the Way, than if he had none at all to peruse, his Stile is Masculine and significant; though diffuse, yet not tedious; even his Repetitions, which are not over-frequent, are diverting: His Digressions are wise, proper, and instructing: One sees a profound Knowledge of Mankind in every Observation that he makes; and that without Ill Nature, Pride, or Passion. Not to mention that peculiar Air of Impartiality, which runs through the whole Work; so that it is not easie to withdraw our Assent from every Thing which he says. To all which I need not add,

add, that his History never tires, though immediately read after *Livy* or *Tacitus*.

In *F. Paul's* History one may also find the Excellencies before observed in *Polybius*; and it has been nicely examined by dextrous and skilful Adversaries, who have taken the Pains to weigh every Period, and rectifie every Date. So that, besides the Satisfaction which any other admirable History would have afforded us, we have the Pleasure of thinking that we may safely rely upon his Accounts of Things, without being mis-guided in any one leading Particular of great moment, since Adversaries, who had no Inclination to spare him, could not invalidate the Authority of a Book which they had so great a Desire to lessen. I had gone no further than *D'Avila* and *Strada*, if there were as much Reason to believe their Narratives, as there is to commend their Skill in writing. *D'Avila* must be acknowledged to be a most Entertaining Historian; one that wants neither Art, Genius, nor Eloquence, to render his History acceptable. *Strada* imitates the old *Romans* so happily, that those who can relish their Eloquence, will be always pleased with his.

Upon the whole Matter, one may positively say, That where any Thing
wherein

wherein Oratory can only claim a Share, has been equally cultivated by the Moderns, as by the Ancients; they have equalled them at least, if not out-done them, setting aside any particular Graces, which might as well be owing to the Languages in which they wrote, as to the Writers themselves.

CHAP. IV.

Reflections upon Monsieur Perrault's Hypothesis, That Modern Orators and Poets are more excellent than Ancient.

Whatever becomes of the Reasons given in the last Chapter, for the Excellency of Ancient Eloquence and Poetry, the Position it self is so generally held, that I do not fear any Opposition here at home. It is almost an Heresie in Wit, among our Poets, to set up any Modern Name against *Homer* or *Virgil*, *Horace* or *Terence*. So that though here and there one should in Discourse prefer the present Age, yet scarce any Man who sets a Value upon his own Reputation, will venture

venture to assert it in Print. Whether this is to be attributed to their Judgment, or Modesty, or both, I will not determine ; though I am apt to believe, to both, because in our Neighbour-Nation, which is remarkable for a good deal of what Sir *William Temple* calls *Sufficiency*, some have spoken much more openly.

For the Members of the Academy in *France*, who since the Cardinal *de Richelieu's* Time, have taken so much Pains to make their Language capable of all those Beauties which they find in Ancient Authors, will not allow me to go so far as I have done. Monsieur *Perrault*, their Advocate, in Oratory sets the Bishop of *Meaux* against *Pericles*, (or rather, *Thucydides*,) the Bishop of *Nismes* against *Isochrates*, *F. Bourdaloue* against *Lysias*, Monsieur *Voiture* against *Pliny*, and Monsieur *Balzac* against *Cicero*. In Poetry likewise he sets Monsieur *Boileau* against *Horace*, Monsieur *Corneille* and Monsieur *Moliere* against the Ancient *Dramatick* Poets. In short, though he owns that some amongst the Ancients had very exalted Genius's, so that it may, perhaps, be very hard to find any Thing that comes near the Force of some of the Ancient Pieces, in either Kind, amongst our Modern Writers, yet he affirms, that Poetry and Oratory

tory are now at a greater height than ever they were, because there have been many Rules found out since *Virgil's* and *Horace's* Time ; and the old Rules likewise have been more carefully scanned than ever they were before. This Hypothesis ought a little to be enquired into ; and therefore I shall offer some few Considerations about his Notion. Sir *William Temple*, I am sure, will not think this a Digression, because the Author of *the Plurality of Worlds*, (e) by censuring of the Old Poetry, (e) Pag. 5. and giving Preference to the New, raised his Indignation ; which no Quality among Men was so apt to raise in him as Sufficiency, the worst Composition out of the Pride and Ignorance of Mankind.

1. Monsieur *Perrault* takes it for granted, that *Cicero* was a better Orator than *Demosthenes* ; because, living after him, the World had gone on for above Two Hundred Years, constantly improving, and adding new Observations, necessary to compleat his Art : And so by Consequence, that the Gentlemen of the Academy must out-do *Tully*, for the same Reasons. This Proposition, which is the Foundation of a great part of his Book, is not very easie to be proved ; because Mankind loves Variety in those Things wherein it may be had so much, that the best Things,

Things, constantly re-iterated, will certainly disgust. Sometimes the Age will not bear Subjects, upon which an Orator may display his full Force; he may often be obliged to little, mean Exercises. A Thousand Accidents, not discoverable at a distance, may force Men to stretch their Inventions to spoil that Eloquence which, left to it self, would do admirable Things. And that there is such a Thing as a Decay of Eloquence in After-Ages, which have the Performances of those that went before constantly to recurr to, and which may be supposed to pretend to Skill and Fineness, is evident from the Writings of *Seneca* and the Younger *Pliny*, compared with *Tully's*.

2. The Ancients cannot justly be accused of not using an exact and artificial Method in their Orations, if one examines *Tully's Pleadings*, or reads over *Quintilian's Institutions*. And if Panegyrics and Funeral-Orations do not seem so regular, it is not because Method was little understood, but because in those Discourses it was not so necessary. Where Men were to reason severely, Method was strictly observed: And the Vertues discoursed upon in *Tully's Offices* are as judiciously and clearly digested under their proper Heads, as the Subject-Matter of
most

most Discourses written by any Modern Author, upon any Subject whatsoever. And it does not seem possible to contrive any Poem, whose Parts can have a truer, or more artful Connexion, than *Virgil's Æneis*: And though it is now objected by Monsieur *Perrault*, as a Fault, that he did not carry on his Poem to the Marriage of *Æneas* and *Lavinia*, yet we may reasonably think, that he had very good Reasons for doing so; because, in *Augustus's* Court, where Matters of that sort were very well understood, it was received with as great Veneration as it has been since; and never needed the Recommendation of Antiquity, to add to its Authority.

Nay, we can give very probable Reasons, at this distance, for it. It is a Fault in Heroick Poetry, to fetch Things from their first Originals: And to carry the Thread of the Narrative down to the last Event, is altogether as dull. As *Homer* begins not with the Rape of *Helen*, so he does not go so far as the Destruction of *Troy*. Men should rise from Table with some Appetite remaining: And a Poem should leave some View of something to follow, and not quite shut the Scenes; especially if the remaining Part of the Story be not capable of much Or-

E nament,

nament, nor affords a Variety. The Passion of Love, with those that always follow upon its being disappointed, had been shown already in the Story of *Dido*. But Monsieur *Perrault* seems to have had his Head possessed with the *Idea* of *French* Romances; which, to be sure, must never fail to end in a general Wedding.

For I observe, *Secondly*, That among other Arguments produced by him, to prove that the Ancients did not perfect their Oratory and Poësie, he urges this; That the Mind of Man, being an inexhaustible Fund of new Thoughts and Projects, every Age added Observations of its own to the former Store; so that they still increased in Politeness, and by Consequence, their Eloquence of all sorts, in Verse or Prose, must needs be more exact. And as a Proof of this Assertion, he instances in Matters of Love: wherein the Writings of the best bred Gentlemen of all Antiquity, for want of Modern Gallantry, of which they had no Notion, were rude and unpolished, if compared with the Poems and Romances of the present Age. Here Monsieur *Perrault's* Skill in Architecture seems to have deceived him: For there is a wide Difference between an Art that, having no Antecedent Foundation in Nature, owes

owes its first Original to some particular Invention, and all its future Improvements to Superstructures raised by other Men upon that first Ground-work ; and between Passions of the Mind, that are Congenial with our Natures ; where Conversation will polish them, even without previous Intentions of doing so ; and where the Experiences of a few Ages, if assisted by Books that may preserve particular Cases, will carry them to as great an Heighth as the Things themselves are capable of. And therefore, he that now examines the Writings of the Ancient Moral Philosophers, *Aristotle* for instance, or the *Stoicks*, will find, that they made as nice Distinctions in all Matters relating to Vertue and Vice ; and that they understood Humane Nature, with all its Passions and Appetites, as accurately as any Philosophers have done since. Besides, It may be justly questioned, whether what Monsieur *Perrault* calls *Politeness*, be not very often rather an Aberration from, and Straining of Nature, than an Improvement of the Manners of the Age : If so, it may reasonably be supposed, that those that meddled not with the Niceties of Ceremony and Breeding, before unpractised, rather condemned them as improper or unnatural,

(e) The
Author of
Astræa.

(f) The
Author of
Cleopatra.

than omitted them because of the Roughness of the Manners of the Ages in which they lived. *Ovid* and *Tibullus* knew what Love was, in its tenderest Motions ; they describe its Anxieties and Disappointments in a Manner that raises too too many Passions, even in unconcerned Hearts ; they omit no probable Arts of Courtship and Address ; and keeping the Mark they aim at still in view, they rather chuse to shew their Passion, than their Wit : And therefore they are not so formal as the Heroes in *Pharamond* or *Cassandra* ; who, by pretending to Exactness in all their Methods, commit greater Improbabilities than *Amadis de Gaule* himself. In short, *Durfe* (e), and *Calprenede* (f), and the rest of them, by over-straining the String, have broke it : And one can as soon believe that *Varillas* and *Maimbourg* wrote the Histories of great Actions just as they were done, as that Men ever made Love in such a Way as these *Love-and-Honour Men* describe. That Simplicity therefore of the Ancients, which Monsieur *Perrault* undervalues, is so far from being a Mark of Rudeness, and Want of Complaisance, that their Fault lay in being too Natural, in making too lively Descriptions of Things, where Men want no Foreign Assistance to help them

them to form their *Idea's*; and where Ignorance, could it be had, is more valuable than any, much more than a Critical Knowledge.

3. Since,

*By that loud Trumpet which our Courage
aids,*

*We learn, that Sound, as well as Sense,
persuades;*

the Felicity of a manageable Language, when improved by Men of nice Ears, and true Judgments, is greater, and goes further to make Men Orators and Poets, than Monsieur *Perrault* seems willing to allow; though there is a plain Reason for his Unwillingness: The *French* Language wants Strength to temper and support its Smoothness for the nobler Parts of Poefie, and perhaps of Oratory too, though the *French* Nation wants no Accomplishments necessary to make a Poet, or an Orator. Therefore their late Criticks are always setting Rules, and telling Men what must be done, and what omitted, if they would be Poets. What they find they cannot do themselves, shall be so clogged where they may have the Management, that others shall be afraid to attempt it. They are too fond of their Language, to acknowledge where the

Fault lies ; and therefore the chief Thing they tell us is, that Sence, Connexion and Method are the principal Things to be minded. Accordingly, they have translated most of the Ancient Poets, even the *Lyrics*, into *French* Prose ; and from those Translations they pass their Judgments, and call upon others to do so too. So that when (to use Sir *J. Denham's* Comparison) by pouring the Spirits of the Ancient Poetry from one Bottle into another, they have lost the most Volatile Parts, and the rest becomes flat and insipid ; these Criticks exclaim against the Ancients, as if they did not sufficiently understand Poetical Chymistry. This is so great a Truth, that even in Oratory it holds, though in a less Degree. *Thucydides* therefore has hard Measure to be compared with the Bishop of *Meaux*, when his Oration is turned into another Language, whilst Monsieur *de Meaux's* stands unaltered ; for, though Sence is Sence in every Tongue, yet all Languages have a peculiar Way of expressing the same Things ; which is lost in Translations, and much more in Monsieur *D' Ablancourt's*, who professed to mind two very different Things at once ; to translate his Author, and to write elegant Books in his own Language ; which last he

he has certainly done ; and he knew that more Persons could find fault with his Stile, if it had been faulty, than find out Mistakes in his Rendring of the *Greek* of *Thucydides*. Besides, the Beauty of the Author's Composition is, in all Translations, entirely lost, though the Ancients were superstitiously exact about it ; and in their elegant Prose, as much almost as in their Verse. So that a Man can have but half an *Idea* of the ancient Eloquence, and that not always faithful, who judges of it without such a Skill in *Greek* and *Latin* as can enable him to read Histories, Orations and Poems in those Languages, with Ease and Pleasure. But it is time to return to my Subject.

C H A P. V.

Of Ancient and Modern Grammar.

Grammar is one of the Sciences which Sir *William Temple* says, that (g) (g)Pag.44: no Man ever disputed with the Ancients.

As this Assertion is expressed, it is a little ambiguous : It may be understood of the Skill of the Moderns in the Gram-

matical Analogy of *Latin* and *Greek*, or of their Skill in the *Grammar* of their Mother-Tongues. Besides, *Grammar* may either be considered *Mechanically*, or *Philosophically*. Those consider it *Mechanically*, who only examine the Idiotisms and Proprieties of every particular Language, and lay down Rules to teach them to others. Those consider it as *Philosophers*, who run over the several Steps, by which every Language has altered its *Idiom*; who enquire into the several Perfections and Imperfections of those Tongues with which they are acquainted, and (if they are living Languages) propose Methods how to remedy them, or, at least, remove those Obscurities which are thereby occasioned in such Discourses where Truth is only regarded, and not Eloquence.

Now, this *Mechanical Grammar* of *Greek* and *Latin* has been very carefully studied by Modern Criticks. *Sanctius*, *Scioppius*, and *Gerhard Vossius*, besides a great Number of others, who have occasionally shown their Skill in their Illustrations of Ancient Authors, have given evident Proofs how well they understood the *Latin* Tongue: So have *Caninius*, *Cleard*, and abundance more, in *Greek*: Wherein they have gone upon sure Grounds,

Grounds, since, besides a great Number of Books in both Languages, upon other Subjects, abundance of Grammatical Treatises, such as *Scholia upon difficult Authors, Glossaries, Onomasticons, Etymologicons, Rudiments of Grammar, &c.* have been preserved, and published by skilful Men (most of them at least) with great Care and Accuracy. So that there is Reason to believe, that some Modern Criticks may have understood the Grammatical Construction of *Latin* as well as *Varro*, or *Cæsar*; and of *Greek* as well as *Aristarchus*, or *Herodian*. But this cannot be pretended to be a new Invention; for the *Grammar* of dead Languages can be only learned by Books: And since their Analogy can neither be increased, nor diminished, it must be left as we find it.

So that when Sir *William Temple* says, *That no Man ever disputed Grammar with the Ancients*; if he means, that we cannot make a new Grammar of a dead Language, whose Analogy has been determined almost Two Thousand Years, it is what can admit of no Dispute. But if he means, that Modern Languages have not been Grammatically examined; at least, not with that Care that some Ancient Tongues have been; that is a Proposition

position which may, perhaps, be very justly questioned. For, in the first place, it ought to be considered, that every Tongue has its own peculiar Form, as well as its proper Words; not communicable to, nor to be regulated by the Analogy of another Language: Wherefore he is the best Grammarian, who is the perfectest Master of the Analogy of the Language which he is about; and gives the truest Rules, by which another Man may learn it. Next, To apply this to our own Tongue, it may be certainly affirmed, that the *Grammar of English* is so far our own, that Skill in the Learned Languages is not necessary to comprehend it. *Ben. Johnson* was the first Man, that I know of, that did any Thing considerable in it; but *Lilly's Grammar* was his Pattern: and for want of Reflecting upon the Grounds of a Language which he understood as well as any Man of his Age, he drew it by Violence to a dead Language that was of a quite different Make; and so left his Work imperfect. After him, came *Dr. Wallis*; who examined the *English* Tongue like a Grammarian and a Philosopher at once, and showed great Skill in that Business: And of his *English Grammar* one may venture to say, That it may be set against any Thing

Thing that is extant of the Ancients, of that kind: For, as Sir *William Temple* says upon another Occasion, there is a *Strain of Philosophy, and curious Thought*, in his previous *Essay of the Formation of the Sounds of Letters*; and of Subtilty in the *Grammar*, in the reducing of our Language under Genuine Rules of Art, that one would not expect in a Book of that kind.

In *France*, since the Institution of the *French Academy*, the *Grammar* of their own Language has been studied with great Care. *Isocrates* himself could not be more nice in the Numbers of his Periods, than these *Academicians* have been in settling the Phraseology, in fixing the Standard of Words, and in making their Sentences, as well as they could, numerous and flowing. Their *Dictionary*, of which a good Part is already printed; *Vaugelas's* and *Bouhours's Remarks upon the French Tongue*, *Richelet's* and *Furetiere's Dictionaries*, with abundance of other Books of that kind, which, though not all written by Members of the *Academy*, yet are all Imitations of the Patterns which they first set, are Evidences of this their Care. This Sir *William Temple* somewhere owns: And though he there supposes, that these *Filers* and *Polishers* may

may have taken away a great part of the Strength of the Tongue, which, in the main, is true enough, yet that is no Objection against their Critical Skill in *Grammar*; upon which Account only their Labours are here taken notice of. So much for the *Mechanical Part of Grammar*.

Philosophical Grammar was never, that we know of, much minded by the Ancients. So that any great Performances of this sort are to be looked upon as Modern Increases to the Commonwealth of Learning. The most considerable Book of that kind, that I know of, is Bishop *Wilkins's Essay towards a Real Character, and Philosophical Language*: A Work, which those who have studied, think they can never commend enough. To this one ought to add, what may be found relating to the same Subject, in the Third Book of Mr. *Lock's Essay of Humane Understanding*.

CHAP. VI.

*Of Ancient and Modern Architecture,
Statuary, and Painting.*

Hitherto the *Moderns* seem to have had very little Reason to boast of their Acquisitions, and Improvements; Let us see now what they may have hereafter. In those Arts, sure, if in any, they may challenge the Preference, which depending upon great Numbers of Experiments and Observations, which do not every Day occur, cannot be supposed to be brought to Perfection in a few Ages. Among such, doubtless, *Architecture*, *Sculpture* and *Painting* may, and ought here to be reckoned; both because they were extremely valued by the *Ancients*, and do still keep up their just Price. They are likewise very properly taken notice of in this Place, because they have always been the Entertainments of Ingenious and Learned Men, whose Circumstances would give them Opportunity to lay out Money upon them, or to please themselves with other Men's Labours. In these Things, if we may take Men's Judgments in their own Professions, the
Ancients

Ancients have far out-done the Moderns. The *Italians*, whose Performances have been the most considerable in this kind, and who, as Genuine Successors of the Old *Romans*, are not apt to undervalue what they do themselves, have, for the most part, given the uncontested Pre-eminence to the Ancient *Greek* Architects, Painters and Sculptors. Whose Authority we ought the rather to acquiesce in, because *Michael-Angelo* and *Bernini*, two wonderful Masters, and not a little jealous of their Honour, did always ingenuously declare, that their best Pieces were exceeded by some of the ancient Statues still to be seen at *Rome*.

Here therefore I at first intended to have left off; and I thought my self obliged to resign what I believed could not be maintained, when Monsieur *Perrault's* *Parallel of the Ancients and Moderns* came to my Hands. His Skill in *Architecture* and *Mechanicks* was sufficiently manifested long ago, in his admirable Translation of, and Commentaries upon *Vitruvius*: And his long Conversation with the finest Pieces of Antiquity, and of these Later Ages, fitted him for judging of these Matters better than other Men. So that, though there might be great Reason not to agree to his Hypothesis of the State of
Ancient

Ancient and Modern Eloquence and Poesie ; yet in Things of this Nature, where the *Mediums* of Judging are quite different, and where Geometrical Rules of Proportion, which in their own Nature are unalterable, go very far to determine the Question, his Judgment seemed to be of great weight. I shall therefore chuse rather to give a short View of what he says upon these Subjects, than to pass any Censure upon them of my own.

Of *Architecture* he says, "That though Pag. 88.
 "the Moderns have received the Know-
 "ledge of the Five Orders from the An-
 "cients, yet if they employ it to better
 "Purposes, if their Buildings be more
 "useful, and more beautiful, then they
 "must be allowed to be the better Archi-
 "tects : For it is in Architecture, as it is
 "in Oratory ; as he that lays down Rules,
 "when and how to use *Metaphors*, *Hy-*
 "*perbole's*, *Prosopopæia's*, or any other
 "Figures of *Rhetorick*, may very often
 "not be so good an Orator as he that uses
 "them judiciously in his Discourses : So
 "he that teaches what a *Pillar*, an *Ar-*
 "*chitrave* or a *Cornice* is, and that in-
 "structs another in the Rules of Propor-
 "tion, so as to adjust all the Parts of each
 "of the several Orders aright, may not
 "be so good an Architect as he that
 "builds

Pag. 95.

“ builds a magnificent Temple, or a no-
 “ ble Palace, that shall answer all those
 “ Ends for which such Structures are de-
 “ signed. That the chief Reason why
 “ the *Doric*, the *Ionic*, or the *Corinthian*
 “ Models have pleased so much, is, part-
 “ ly because the Eye has been long accu-
 “ stomed to them, and partly because
 “ they have been made use of by Men
 “ who understood and followed those o-
 “ ther Rules which will eternally please,
 “ upon the Score of real Usefulness;
 “ whereas the Five Orders owe their Au-
 “ thority to Custom, rather than to Na-
 “ ture. That these Universal Rules are;
 “ To make those Buildings which will
 “ bear it, lofty and wide: In Stone-work,
 “ to use the largest, the smoothest, and
 “ the evenest Stones: To make the Joints
 “ almost imperceptible: To place the per-
 “ pendicular Parts of the Work exactly
 “ Perpendicular, and the Horizontal Parts
 “ exactly Horizontal: To support the
 “ weak Parts of the Work by the strong:
 “ to cut Square Figures perfectly Square,
 “ and Round Figures perfectly Round:
 “ To hew the whole exactly true; and
 “ to fix all the Corners of the Work even-
 “ ly, as they ought to be. That these
 “ Rules, well observed, will always please
 “ even those who never understood one
 “ single

“ single Term of Art : Whereas the other
 “ accidental Beauties, such as he suppo-
 “ ses *Doric, Ionic, or Corinthian* Work to
 “ be, please, only because they are found
 “ together with these, though their be-
 “ ing the most conspicuous Parts of a
 “ Building made them be first observed :
 “ From whence Men began to fantasie In-
 “ herent Beauties in that, which owes the
 “ greatest part of its Charms to the good
 “ Company in which it is taken notice
 “ of, and so in time delighted, when it
 “ was seen alone. That otherwise it Pag. 97, 99
 “ would be impossible that there should
 “ be so great a Variety in the Assigning
 “ of the Proportions of the several Or-
 “ ders; no two eminent Architects ever
 “ keeping to the same Measure, though
 “ they have neither spoiled nor lessened
 “ the Beauty of their Works. That if
 “ we go to Particulars, we shall not find
 “ (for the purpose) in the *Pantheon* at
 “ *Rome*, which is the most regular, and
 “ the most magnificent ancient Building
 “ now extant, two Pillars of a like thick-
 “ ness. That (a) the Girders of the
 “ arched Roof do not lie full upon the
 “ great Columns or Pilasters; but some
 “ quite over the Cavities of the Win-
 “ dows which are underneath; others
 “ half over the Windows, and half upon

(a) *Ban-*
deaux de la
voute du
Temple.
 Pag. 111.
 Pag. 113.

Pag. 114.

“ the Columns or Pilasters. That the Mo-
 “ dillions of the Cornice are not exactly
 “ over the Middle of the Chapiters of the
 “ Pillars. That in the Fronts of the Pia-
 “ za’s, the Number of the Modillions in
 “ Sides of equal length is not alike: With
 “ several Instances of Negligence, which
 “ would now be thought unpardonable.
 “ That, generally speaking, in other Build-
 “ ings, their Floors were twice as thick as
 “ their Walls; which loaded them exceed-

Pag. 115.

“ ingly, to no purpose. That their Way of
 “ Laying Stones in Lozenges was incon-
 “ venient as well as troublesome, since
 “ every Stone so placed was a Wedge to
 “ force those asunder on which it leaned.

Pag. 117.

“ That they did not understand the nicest
 “ Thing in Architecture, which is, the
 “ Art of Cutting Stones in such a man-
 “ ner, as that several Pieces might be
 “ jointed one into another; for want of
 “ which, they made their Vaults of Brick
 “ plaster’d over; and their Architraves
 “ of Wood, or of one single Stone; which
 “ obliged them to set their Pillars closer
 “ to one another than otherwise had been
 “ necessary: Whereas, by this Art of Cut-
 “ ting Stone, Arches have been made al-
 “ most flat; Stair-Cases of a vast height
 “ have been rais’d, where the Spectator
 “ is at a loss to tell what supports them;
 “ whilst

“ whilst the Stones are jointed into each
 “ other in such a manner, that they mu-
 “ tually bear up themselves, without any
 “ Rest but the Wall, into which the in-
 “ nermost Stones are fastned. That they Pag. 118.

“ had not Engines to raise their Stones to
 “ any considerable height; but if the
 “ Work was low, they carried them up-
 “ on their Shoulders; if high, they rais-
 “ ed sloping Mounts of Earth level with
 “ their Work, by which they rolled up
 “ their Stones to what height they plea-
 “ sed: For, as for the Engines for Raising
 “ of Stones in *Vitruvius*, those who un-
 “ derstand Mechanicks are agreed, that
 “ they can never be very serviceable.
 “ That it is not the Largeness of a Build-
 “ ing, but the well executing of a Noble
 “ Design, which commends an Archi-
 “ tect; otherwise the *Egyptian* Pyramids,
 “ as they are the greatest, would also be
 “ the finest Structures in the World. And
 “ last of all, That the *French King's* Pa- Pag. 119,
 “ lace at *Versailles*, and the Frontispiece of 120.
 “ the *Louvre*, discover more true Skill in
 “ Architecture of all sorts, than any thing
 “ which the Ancients ever performed, if
 “ we may judge of what is lost, by what
 “ remains.”

What Monsieur *Perrault* says of the
 Ancients Way of Raising their Stone,

The Parthenon &c

may be confirmed by the Accounts which *Garfilasso de la Vega*, and others, give of the vast Buildings of massy Stone which the *Spaniards* found in *Peru*, upon their first Arrival. It is most certain that the *Peruans* knew not the Use of Iron; and by consequence, could make no Engines very serviceable for such a purpose. They ground their Stones one against another, to smooth them; and afterwards they raised them with Leavers: And thus, with Multitude of Hands they reared such Structures as appeared wonderful, even to Men acquainted with Modern Architecture.

Pag. 121.

Of Sculpture he says; 'That we are to distinguish between entire Statues, and *Basso Relievo's*; and in entire Statues, between naked and cloathed Pieces. The naked Images of the Ancients, as *Hercules, Apollo, Diana, the Gladiators, the Wrestlers, Bacchus, Laocoon*, and some few more, are truly admirable:

Pag. 125.

'They shew something extreamly noble, which one wants Words for, that is not to be found in Modern Work: Though he cannot tell whether Age does not contribute to the Beauty. That if some of the most excellent of the Modern Pieces should be preserved 1500 or 2000 Years, or ting'd with some Chymical Water,

‘ Water, that could in a short time make
 ‘ them appear Antique, it is probable
 ‘ they would be viewed with the same Ve-
 ‘ neration which is now payed to Ancient
 ‘ Statues. That the naked Sculpture of ^{Pag. 129.}
 ‘ single Figures is a very noble Art indeed,
 ‘ but the simplest of any that has ever
 ‘ charmed Mankind; not being burthen’d
 ‘ with a Multiplicity of Rules, nor need-
 ‘ ing the Knowledge of any other Art to
 ‘ compleat it; since a Man that has a Ge-
 ‘ nius, and Application, wants only a beau-
 ‘ tiful Model in a proper Posture, which
 ‘ he is faithfully to copy: And therefore,
 ‘ That in the Cloathed Statues of the An- ^{Pag. 121.}
 ‘ cients, the Drapery wants much of that
 ‘ Art which is discernable in some Mo-
 ‘ dern Pieces; they could never make the
 ‘ Clothes fit loose to the Bodies, nor ma-
 ‘ nage the Folds so as to appear easie and
 ‘ flowing, like well-made Garments up-
 ‘ on living Bodies. That the *Basso Relie-* ^{Pag. 129.}
 ‘ *vo*’s of the Ancients plainly show, that
 ‘ the Statuaries in those Days did not un-
 ‘ derstand all the Precepts that are neces-
 ‘ sary to compleat their Art; because they
 ‘ never observed the Rules of Perspective,
 ‘ they did not lessen their Figures gra-
 ‘ dually, to make them suitable to the
 ‘ Place where they stood, but set them
 ‘ almost all upon the same Line; so that

' those behind were as large, and as di-
 ' stinguishable, as those before ; as if they
 ' had been purposely mounted upon Steps,
 ' to be seen over one another's Heads.
 Pag. 130. ' That this is visible in the *Columna Tra-*
 ' *jana* at this Day, though that is the no-
 ' blest ancient Performance in *Basso Relievo*
 ' still remaining ; wherein, together with
 Pag. 132. ' some very beautiful *Airs* of some of the
 ' Heads, and some very happy Postures,
 ' one may discern that there is scarce any
 ' Art in the Composition of the whole,
 ' no lessening of the *Relievo* in any part,
 ' with great Ignorance in Perspective in
 Pag. 133. ' the whole. That the ancient Works in
 ' *Basso Relievo* did not truly deserve that
 ' Name, being properly entire Statues,
 ' either sawed down perpendicularly,
 ' from Head to Foot, with the fore-part
 ' fastned, or glued to a flat Ground, or
 Pag. 134. ' sunk half way in : Whereas the true
 ' Art consists in raising the Figures so from
 ' their Ground, which is of the same
 ' Piece, that with two or three Inches of
 ' *Relievo*, they may appear like distinct
 ' Images rising out of the Ground, some
 ' more, some less, according to the seve-
 ' ral Distances in which they ought to be
 ' placed.

Pag. 143. ' Of *Painting*, he says ; ' That three Things
 ' are necessary to make a perfect Picture ;
 ' To

' To represent the Figures truly ; To express
 ' the Passions naturally ; and, To put the
 ' whole judiciously together. For the First,
 ' It is necessary that all the Out-Lines be
 ' justly drawn, and that every Part be
 ' properly coloured. For the Second, It
 ' is necessary that the Painter should hit
 ' the different Airs and Characters of the
 ' Face, with all the Postures of the Fi-
 ' gures, so as to express what they do,
 ' and what they think. The whole is ju-
 ' diciously put together, when every several
 ' Figure is set in the Place in which we
 ' see it, for a particular Purpose ; and the
 ' Colouring gradually weakned, so as to
 ' suit that part of the Plain in which every
 ' Figure appears. All which is as appli-
 ' cable to the several Parts of a Picture
 ' that has but one Figure, as to the sever-
 ' al Figures in a Picture that has more.
 ' That if we judge of Ancient and Mo- Pag. 135.
 ' dern Paintings by this Rule, we may di-
 ' vide them into three Classes : The First
 ' takes in the Age of *Zeuxis, Apelles, Ti-*
 ' *manthes*, and the rest that are so much
 ' admired in Antiquity. The Second
 ' takes in the Age of *Raphael, Titian,*
 ' *Paul Veronese*, and those other great
 ' Masters that flourished in *Italy* in the
 ' last Age. The Third contains the Pain-
 ' ters of our own Age ; such as *Poussin,*

Pag. 136.

Pag. 139.

Pag. 141.

' *Le Brun*, and the like. That if we
 ' may judge of the Worth of the Painters
 ' of the First Classe by the Commenda-
 ' tions which have been given them, we
 ' have Reason to say, either that their
 ' Admirers did not understand Painting
 ' well, or that themselves were not so va-
 ' luable, or both. That whereas *Zeuxis*
 ' is said to have painted a Bunch of Grapes
 ' so naturally, that the Birds pecked at
 ' them; Cooks have, of late Years, reach-
 ' ed at Partridges and Capons, painted in
 ' Kitchens; which has made By-standers
 ' smile, without raising the Painter's Re-
 ' putation to any great height. That
 ' the Contention between *Protogenes* and
 ' *Apelles* shewed the Infancy of their Art:
 ' *Apelles* was wonderfully applauded for
 ' drawing a very fine Stroke upon a Ta-
 ' ble: *Protogenes* drew a Second over that,
 ' in a different Colour; which *Apelles*
 ' split into two, by a Third. Yet this
 ' was not so much as what *Giotto* did,
 ' who lived in the Beginning of the Resto-
 ' ration of Painting in *Italy*; who drew,
 ' without Compasses, with a single
 ' Stroke of a Pencil, upon a Board, an O,
 ' so exquisitely round, that it is still pro-
 ' verbial among the *Italians*, when they
 ' would describe a Man that is egregiouf-
 ' ly stupid, to say, *That he is as round as*
 ' the

‘ the O of Giotto. That when Poussin’s
‘ Hand shook so much, that he could
‘ scarce manage his Pencil, he painted
‘ some Pieces of inestimable Value ; and
‘ yet very indifferent Painters would have
‘ divided every Line that he drew, into
‘ nine or ten Parts. That the *Chineses*, Pag. 142.
‘ who cannot yet express Life and Passion
‘ in their Pieces, will draw the Hairs of
‘ the Face and Beard so fine, that one
‘ may part them with the Eye from one
‘ another, and tell them. Though the Pag. 150.
‘ Ancients went much beyond all this ;
‘ for the Remains of the ancient Painting
‘ discover great Skill in Designing, great
‘ Judgment in Ordering of the Postures,
‘ much Nobleness and Majesty in the Airs
‘ of the Heads ; but little Art, at the
‘ same time, in the Mixing of their Co-
‘ lours, and none at all in the Perspective,
‘ or the Placing of the Figures. That
‘ their Colouring is all equally strong ;
‘ nothing comes forward, nothing falls
‘ back in their Pictures ; the Figures are
‘ almost all upon a Line ; So that their
‘ Paintings appear like Pieces in *Bas-*
‘ *so Relievo*, coloured ; all dry and un-
‘ moveable, without Union, without Con-
‘ nexion, and that living Softness which
‘ distinguishes Pictures from Statues in
‘ Marble or Copper. Wherefore, since the
‘ Paintings

‘ Paintings of these Ancient Masters were
 ‘ justly designed, and the Passions of eve-
 ‘ ry several Figure naturally expressed,
 ‘ which are the Things that the Genera-
 ‘ lity of Judges most admire, who can-
 ‘ not discern those Beauties that result
 ‘ from a judicious Composition of the
 ‘ whole, so well as they can the distinct
 ‘ Beauties of the several Parts, there is no
 ‘ Wonder that *Zeuxis* and *Apelles*, and
 ‘ the other Ancient Masters, were so fa-
 ‘ mous, and so well rewarded. For, of
 ‘ the three Things at first assigned, as ne-
 ‘ cessary to a perfect Painter, true Draw-
 ‘ ing, with proper Colouring, affect the
 ‘ Senses; natural Expressing of the Mo-
 ‘ tions of the Soul move the Passions;
 Pag. 146. ‘ whereas a Judicious Composition of the
 ‘ whole, which is discernable in an Art-
 ‘ ful Distribution of Lights and Shades,
 ‘ in the gradual Lessening of Figures, ac-
 ‘ cording to their respective Places, in ma-
 ‘ king every Figure answer to that parti-
 ‘ cular Purpose which it is intended to re-
 ‘ present, affects the Understanding only;
 ‘ and so, instead of Charming, will ra-
 ‘ ther disgust an unskilful Spectator.
 Pag. 147. ‘ Such a Man, and under this Head al-
 ‘ most all Mankind may be comprehend-
 ‘ ed, will contentedly forgive the grossest
 ‘ Faults in Perspective, if the Figures are
 ‘ but

‘ but very prominent, and the View not
‘ darkned by too much Shade; which,
‘ in their Opinion, spoils all Faces, espe-
‘ cially of Friends, whose Images chiefly
‘ such Men are desirous to see.

When he compares the Paintings of
Raphael and *Le Brun* together, he ob-
serves, ‘ That *Raphael* seems to have had Pag. 159.

‘ the greater Genius of the two; that there
‘ is something so Noble in his Postures,
‘ and the Airs of his Heads; something
‘ so just in his Designs, so perfect in the
‘ Mixture of his Colours, that his *St. Mi-*
‘ *chael* will always be thought the first
‘ Picture in the World, unless his *H.*
‘ *Family* should dispute Precedency with
‘ it. In short, he says, That if we consi- Pag. 160.

‘ der the Persons of *Raphael* and *Le Brun*,
‘ *Raphael* perhaps may be the greater
‘ Man: But if we consider the Art, as a
‘ Collection of Rules, all necessary to be
‘ observed to make it perfect, it appears
‘ much more compleat in Monsieur *Le*
‘ *Brun*’s Pieces: For *Raphael* understood
‘ so little of the gradual Lessening of
‘ Light, and Weakning of Colours, which
‘ is caused by the Interposition of the Air,
‘ that the hindmost Figures in his Pieces
‘ appear almost as plain as the foremost;
‘ and the Leaves of distant Trees, almost
‘ as visible as of those near at hand; and
‘ the

French

' the Windows of a Building four Leagues
 ' off may all be counted as easily as of one
 ' that is within twenty Paces. Nay, he
 ' cannot tell whether some part of that
 ' Beauty, now so peculiar to *Raphael's*
 ' Pieces, may not, in a great Measure,
 ' be owing to Time, which adds a real
 ' Beauty to good Paintings. For, in
 ' Works of this kind, as in New-killed
 ' Meat, or New-gathered Fruit, there is
 ' a Rawness and Sharpness, which Time
 ' alone concocts and sweetens, by mortifying that which has too much Life, by
 ' weakning that which is too strong, and
 ' by mixing the Extremities of every Colour entirely into one another. So that
 ' no Man can tell what will be the Beauty
 ' of *Le Brun's Family of Darius, Alexander's Triumph, the Defeat of Porus*, and
 ' some other Pieces of equal Force, when
 ' Time shall have done her Work, and
 ' shall have added those Graces which are
 ' now so remarkable in the *St. Michael*,
 ' and the *H. Family*. One may already
 ' observe, that Monsieur *Le Brun's* Pieces
 ' begin to soften; and that Time has, in
 ' part, added those Graces which it alone
 ' can give, by sweetning what was left on
 ' purpose, by the judicious Painter, to amuse its Activity, and to keep it from
 ' the Substance of the Work'. Thus far
 Monsieur *Perrault*. Whe-

Pag. 161.

Whether his Reasonings are just, I dare not determine: Thus much may very probably be inferred, That *in these Things also* the World does not decay so fast as Sir *William Temple* believes; and that *Poussin, Le Brun* and *Bernini* have made it evident by their Performances in Painting and Statuary, (h) *That we have* (h)Pag. 52: *had Masters in both these Arts, who have deserved a Rank with those that flourished in the last Age, after they were again restored to these Parts of the World.*

CHAP. VII.

General Reflections relating to the following Chapters: With an Account of Sir William Temple's Hypothesis of the History of Learning.

IF the bold Claims of confident and numerous Pretenders might, because of their Confidence and Numbers, be much relied on, it were an easie Thing to determine the present Question, without any further Trouble. The Generality of the Learned have given *the Ancients* the Preference

Preference in those Arts and Sciences which have hitherto been considered : But for the Precedency in those Parts of Learning which still remain to be enquired into, *the Moderns* have put in their Claim, with great Briskness. Among this Sort, I reckon *Mathematical* and *Physical Sciences*, considered in their largest Extent. These are Things which have no Dependence upon the Opinions of Men for their Truth ; they will admit of fixed and undisputed *Mediums* of Comparison and Judgment : So that, though it may be always debated, who have been the best Orators, or who the best Poets ; yet it cannot always be a Matter of Controversie, who have been the greatest Geometers, *Arithmeticians*, *Astronomers*, *Musicians*, *Anatomists*, *Chymists*, *Botanists*, or the like ; because a fair Comparison between the Inventions, Observations, Experiments and Collections of the contending Parties must certainly put an End to the Dispute, and give a more full Satisfaction to all Sides.

The Thing contended for on both Sides is, the *Knowledge of Nature* ; what the Appearances are which it exhibits, and how they are exhibited ; thereby to show how they may be enlarged, and diversified, and Impediments of any sort removed.

ved. In order to this, it will be necessary,
(1.) To find out all the several Affections
and Properties of Quantity, abstractedly
considered; with the Proportions of its
Parts and Kinds, either severally con-
sidered, or compared with, or compound-
ed with one another; either as they may
be in Motion, or at Rest. This is
properly the *Mathematician's* Business.
(2.) To collect great Numbers of Obser-
vations, and to make a vast Variety of
Experiments upon all sorts of Natural
Bodies. And because this cannot be done
without proper Tools, (3.) To contrive
such Instruments, by which the Consti-
tuent Parts of the Universe, and of all its
Parts, even the most minute, or the most
remote, may lie more open to our View;
and their Motions, or other Affections,
be better calculated and examined, than
could otherwise have been done by our
unassisted Senses. (4.) To range all the
several Species of Natural Things under
proper Heads; to assign fit Characteri-
sticks, or Marks, whereby they may be
readily found out, and distinguished from
one another. (5.) To adapt all the Ca-
tholick Affections of Matter and Motion
to all the known Appearances of Things,
so as to be able to tell how Nature works;
and, in some particular Cases, to com-
mand

mand her. This will take in *Astronomy*, *Mechanicks*, *Opticks*, *Musick*, with the other *Physico-Mathematical* and *Physico-Mechanical* Parts of Knowledge ; as also, *Anatomy*, *Chymistry*, with the whole Extent of *Natural History*. It will help us to make a just Comparison between the *Ancient* and *Modern Physicks* ; that so we may certainly determine who Philosophized best, *Aristotle* and *Democritus*, or *Mr. Boyle* and *Mr. Newton*.

In these Things therefore the Comparison is to be made, wherein one can go no higher than the Age of *Hypocrates*, *Aristotle* and *Theophrastus*, because the Writings of the Philosophers before them are all lost. It may therefore be plausibly objected, that this is no fair Way of Proceeding, because the *Egyptians* and *Chaldeans* were famous for very many Parts of real Learning long before ; from whom *Pythagoras*, *Thales*, *Plato*, and all the other *Græcian* Philosophers, borrowed what they knew. This *Sir William Temple* insists at large upon ; so that it will be necessary to examine the Claims of these Nations to Universal Learning : In doing of which, I shall follow *Sir William Temple's* Method ; and first give a short Abstract of his Hypothesis, and then enquire how far it may be relied on.

Sir *William Temple* tells us, That the chiefest Argument that is produced in behalf of the Moderns, is ; ‘(i) That they (i) Pag. 5. ‘have the Advantage of the Ancients ‘Discoveries to help their own: So ‘that, like Dwarfs upon Giants Shoulders, they must needs see farther than ‘the Giants themselves.” To weaken this, we are told, ‘(k) That those whom (k) Pag. 6---10. ‘we call Ancients, are Moderns, if compared to those who are ancients than ‘they : And that there were vast Lakes ‘of Learning in *Egypt, Chaldea, India* ‘and *China* ; where it stagnated for many ‘Ages, till the *Greeks* brought Buckets, ‘and drew it out.”

The Question which is first to be asked here, is, *Where are the Books and Monuments wherein these Treasures were deposited for so many Ages?* And because they are not to be found, Sir *William Temple* makes a Doubt, (l) *Whether Books advance any other Science, beyond the particular Records of Actions, or Registers of Time.* He may resolve it soon, if he enquires how far a Man can go in Astronomical Calculations, for which the *Chaldeans* are said to be so famous, without the Use of Letters. The *Peruan* Antiquities, which he there alledges, for Twelve or Thirteen Generations, from

Mango Capac, to *Atahualpa*, were not of above Five Hundred Years standing. The *Mexican* Accounts were not much older; and yet these, though very rude, needed Helps to be brought down to us. The *Peruan* Conveyances of Knowledge, according to *Garçilasso de la Vega*, were not purely Traditionary, but were Fringes of Cotton, of several Colours, tied and woven with a vast Variety of Knots, which had all determinate Meanings; and so supplied the Use of Letters, in a tolerable Degree: And the *Mexican* Antiquities were preserved, after a sort, by Pictures; of which we have a Specimen in *Purchas's Pilgrim*. So that when Sir *William Temple* urges the Traditions of these People, to prove that Knowledge may be conveyed to Posterity without Letters, he proves only what is not disputed, namely, That Knowledge can be imperfectly conveyed to Posterity without Letters; not that Tradition can preserve Learning as well as Books, or something equivalent.

But since Sir *William Temple* lays no great Weight upon this Evasion, I ought not to insist any longer upon it. He says
 (m) Pag. 6 (m) therefore, 'That it is a Question,
 'whether the Invention of Printing has
 'multiplied Books, or only the Copies of
 'them;

‘ them ; since, if we believe that there
 ‘ were 600000 Books in the *Ptolemaean*
 ‘ Library, we shall hardly pretend to
 ‘ equal it by any of ours, nor perhaps by
 ‘ all put together ; that is, we shall be
 ‘ scarce able to produce so many Originals
 ‘ that have lived any Time, and thereby
 ‘ given Testimony of their having been
 ‘ thought worth preserving,’ All this,
 as it is urged by Sir *William Temple*, is
 liable to great Exception. For, (1.) If
 we should allow that there is no Hyper-
 bole in the Number of Books in the *Pto-*
lemaean Library, yet we are not to take
 our Estimate by our Way of Reckoning.
 Every Oration of *Demosthenes* and *Isocra-*
tes, every Play of *Æschylus* or *Aristopha-*
nes, every Discourse of *Plato* or *Aristotle*,
 was anciently called a Volume. This
 will lessen the Number to us, who take
 whole Collections of every Author’s
 Works in one Lump ; and call them ac-
 cordingly in our Catalogues, if printed
 together, but by one Title. (2.) Sir *Wil-*
liam Temple seems to take it for granted,
 that all these Books were *Originals* ; that
 is to say, Books *worth preserving* ; which
 is more than any Man can now prove.
 I suppose he himself believes that there
 were Ancients of all Sorts and Sizes, as
 well as there are Moderns now. And

he that raises a Library, takes in Books of all Values ; since bad Books have their Uses to Learned Men, as well as good ones. So that, for any Thing we know to the contrary, there might have been in this *Alexandrian* Library a great Number of (n) *Scribblers, that, like Mushrooms or Flies, are born and die in small Circles of Time.* (3.) The World can make a better Judgment of the Value of what is lost, at least, as it relates to the present Enquiry, than one at first View might perhaps imagine. The lost Books of the *Antiquity of several Nations, of their Civil History, of the Limits of their several Empires and Commonwealths, of their Laws and Manners, or of any Thing immediately relating to any of these*, are not here to be considered, because it cannot be pretended that the Moderns could know any of these Things, but as they were taught. So neither is what may have related to *Ethicks, Politicks, Poesie and Oratory* here to be urged, since in those Matters, the Worth of Ancient Knowledge has already been asserted. So that one is only to enquire what and how great the Loss is of all those Books upon Natural or Mathematical Arguments, which were preserved in the *Alexandrian, Asiatick and Roman* Libraries, or

or mentioned in the Writings of the Ancient Philosophers and Historians. By which Deduction, the former Number will be yet again considerably lessened.

Now, a very true Judgment of Ancient Skill in Natural History may be formed out of *Pliny*, whose Extracts of Books, still extant, are so particular for the present Purpose, that there is Reason to believe they were not made carelessly of those that are lost. *Galen* seems to have read whatever he could meet with relating to Medicine, in all its Parts: And the Opinions of Abundance of Authors, whose Names are no where else preserved, may be discovered out of his Books; of the famous ones especially; whom at every Turn he either contradicts, or produces to fortifie his own Assertions. *Ptolemee* gives an Account of the old Astronomy in his *Almagest*. Very many Particulars of the Inventions and Methods of Ancient Geometers are to be found in the Mathematical Collections of *Pappus*. The Opinions of the different Sects of Philosophers are well enough preserved in the entire Treatises of the several Philosophers who were of their Sects; or in the Discourses of others, who occasionally or expressly confute what they say. So that I am apt to think, that the Philosophical and Mathe-

mathematical Learning of the Ancients is better conveyed to us than the Civil; the Books which treated of those Subjects suiting better the Genius's of several Men, and of several Nations too: For which Reason the *Arabs* translated the most considerable *Greek* Books of this kind; as, *Euclid*, *Apollonius*, *Aristotle*, *Epicetus*, *Cebes*, and Abundance more, that had written of Philosophy or Mathematicks, into their own Language; whilst they let Books of Antiquity and Civil History lie unregarded.

Sir *William Temple's* next Enquiry is, From whence both the Ancients and Moderns have received their Knowledge? His Method does not seem to be very natural, nor his Question very proper, since, if Discoveries are once made, it is not so material to know who taught the several Inventors, as what these Inventors first taught others. But setting that aside, the Summ of what he says, in short, is this:

(o) Pag.
11, 12.

' (o) The Moderns gather all their
' Learning out of Books in Universities;
' which are but dumb Guides, that can
' lead Men but one Way, without being
' able to set them right if they should
' wander from it. These Books, besides,
' are very few; the Remains of the Writings of here and there an Author, that
' wrote

‘ wrote from the Time of *Hippocrates*, to
 ‘ *M. Antoninus*, in the Compass of Six or
 ‘ Seven Hundred Years : Whereas *Thales*
 ‘ and *Pythagoras* took another sort of a Me-
 ‘ thod ; *Thales* acquired his Knowledge
 ‘ in *Egypt*, *Phœnicia*, *Delphos* and *Crete* ;
 ‘ (p) *Pythagoras* spent Twenty Two Years (p) Pag.
 ‘ in *Egypt*, and Twelve Years more in 13, 14, 15.
 ‘ *Chaldea*, and then returned, laden with
 ‘ all their Stores ; and not contented with
 ‘ that, went into *Ethiopia*, *Arabia*, *In-*
 ‘ *dia* and *Crete* ; and visited *Delphos*, and
 ‘ all the renowned Oracles in the World.

‘ (q) Lest we should wonder why *Py-* (q) Pag.
 ‘ *thagoras* went so far, we are told, that 16, 17.
 ‘ the *Indian Brachmans* were so careful to
 ‘ educate those who were intended for
 ‘ Scholars, that as soon as the Mothers
 ‘ found themselves with Child, much
 ‘ Thought and Diligence was employed
 ‘ about their Diet and Entertainment, to
 ‘ furnish them with pleasant Imagina-
 ‘ tions, to compose their Mind and their
 ‘ Sleeps with the best Temper, during the
 ‘ Time that they carried their Burthen.
 ‘ It is certain that they must needs have
 ‘ been very learned, since they were ob-
 ‘ liged to spend Thirty Seven Years in
 ‘ getting Instruction : Their Knowledge
 ‘ was all Traditional ; they thought the
 ‘ World was round, and made by a Spi-

(r) Pag.
22, 23.

‘rit; they believed the Transmigration
 ‘of Souls; and they esteemed Sickness
 ‘such a Mark of Intemperance, that
 ‘when they found themselves indisposed,
 ‘they died out of Shame and Sullenness,
 ‘though some lived an Hundred and Fif-
 ‘ty or Two Hundred Years. (r) These
 ‘Indians had their Knowledge, in all
 ‘probability, from *China*, a Country
 ‘where Learning had been in Request
 ‘from the Time of *Fohius*, their first
 ‘King. It is to be presumed, that they
 ‘communicated of their Store to other
 ‘Nations, though they themselves have
 ‘few Foot-steps of it remaining, besides
 ‘the Writings of *Confucius*, which are
 ‘chiefly Moral and Political; because one
 ‘of their Kings, who desired that the
 ‘Memory of every Thing should begin
 ‘with himself, caused Books of all sorts,
 ‘not relating to Physick and Agriculture,
 ‘to be destroyed.

(s) Pag.
21.

‘(s) From *India*, Learning was car-
 ‘ried into *Ethiopia* and *Arabia*; thence,
 ‘by the Way of the *Red Sea*, it came in-
 ‘to *Phœnicia*; and the *Egyptians* learnt it
 ‘of the *Ethiopians*.

This is a short Account of the History
 of Learning, as Sir *William Temple* has
 deduced it from its most ancient Begin-
 nings. The Exceptions which may be
 made

made against it are many, and yet more against the Conclusions which he draws from it: For, though it be certain that the *Egyptians* had the Grounds and Elements of most parts of real Learning among them earlier than the *Greeks*, yet that is no Argument why the *Grecians* should not go beyond their Teachers, or why the Moderns might not out-do them both.

Before I examine Sir *William Temple's* Scheme, Step by Step, I shall offer, as the Geometers do, some few Things as *Postulata*, which are so very plain, that they will be assented to as soon as they are proposed. (1.) That all Men who make a Mystery of Matters of Learning, and industriously oblige their Scholars to conceal their Dictates, give the World great Reason to suspect, that their Knowledge is all Juggling and Trick. (2.) That he that has only a Moral Persuasion of the Truth of any Proposition, which is capable of Natural Evidence, cannot so properly be esteemed the Inventor, or the Discoverer rather, of that Proposition, as another Man, who, tho' he lived many Ages after, brings such Evidences of its Certainty, as are sufficient to convince all competent Judges; especially when his Reasonings are founded upon

upon Observations and Experiments drawn from, and made upon the Things themselves. (3.) That no Pretences to greater Measures of Knowledge, grounded upon Account of Long Successions of Learned Men in any Country, ought to gain Belief, when set against the Learning of other Nations, who make no such Pretences, unless Inventions and Discoveries answerable to those Advantages, be produced by their Advocates. (4.) That we cannot judge of Characters of Things and Persons at a great Distance, when given at Second-hand, unless we knew exactly how capable those Persons, from whom such Characters were first taken, were to pass a right Judgment upon such subjects; and also the particular Motives that biased them to pass such Censures. If *Archimedes* should, upon his own Knowledge, speak with Admiration of the *Egyptian* Geometry, his Judgment would be very considerable: But if he should speak respectfully of it, only because *Pythagoras* did so before him, it might, perhaps, signify but very little. (5.) That excessive Commendations of any Art or Science whatsoever, as also of the Learning of any particular Men or Nations, only prove that the Persons who give such Characters never heard of any Thing

Thing or Person that was more excellent in that Way ; and therefore that Admiration may be as well supposed to proceed from their own Ignorance, as from the real Excellency of the Persons or Things ; unless their respective Abilities are otherwise known.

C H A P. VIII.

Of the Learning of Pythagoras, and the most Ancient Philosophers of Greece.

I N my Enquiries into the Progress of Learning during its obscurer Ages, or those, at least, which are so to us at this Distance, I shall begin with the Accounts which are given of the Learning of *Pythagoras*, rather than those of the more Ancient *Grecian* Sages ; because his School made a much greater Figure in the World, than any of those which preceded *Plato* and *Aristotle*. In making a Judgment upon the Greatness of his Performances, from the Greatness of his Reputation, one ought to consider how near to his Time those lived, whose express Relations of his Life are the oldest we have.

Diogenes

Diogenes Laërtius is the ancientest Author extant, that has purposely written the Life of *Pythagoras*: According to *Menagius's* Calculations, he lived in *M. Antoninus's* Time: And all that we learn from *Diogenes* is only, that we know very little certainly about *Pythagoras*. He cites, indeed, great Numbers of Books; but those so very disagreeing in their Relations, that a Man is confounded with their Variety. Besides, the *Grecians* magnified every Thing that they commended, so much, that it is hard to guess how far they may be believed when they write of Men and Actions at any Distance from their own Time. *Græcia Mendax* was almost proverbial amongst the *Romans*. But by what appears from the Accounts of the Life of *Pythagoras*, he is rather to be ranked among the Lawgivers, with *Lycurgus* and *Solon*, and his own two Disciples, *Zaleucus* and *Charondas*, than amongst those who really carried Learning to any considerable height. Therefore, as some other Legislators had, or pretended to have, Super-natural Assurances, that they might create a Regard for their Laws in the People to whom they gave them; so *Pythagoras* found out several Equivalents, which did him as much Service. He is said, indeed, to have

have lived many Years in *Egypt*, and to have conversed much with the Philosophers of the *East*; but if he invented the XLVIIth. Proposition in the First Book of *Euclid*, which is unanimously ascribed to him by all Antiquity, one can hardly have a profound Esteem for the Mathematical Skill of his Masters. It is, indeed, a very noble Proposition, the Foundation of Trigonometry, of universal and various Use in those curious Speculations of Incommensurable Numbers; which his Disciples from him, and from them the *Platonists*, so exceedingly admired. But this shews the Infancy of Geometry in his Days, in that very Country which claims the Glory of Inventing it to herself. It is probable, indeed, that the *Egyptians* might find it out; but then we ought also to take notice, that it is the only very considerable Instance of the real Learning of *Pythagoras* that is preserved. Which is the more observable, because the *Pythagoreans* paid the greatest Respect to their Master, of any Sect whatsoever; and so we may be sure that we should have heard much more of his Learning, if much more could have been said: And though the Books of *Hermippus* and *Aristoxenus* (t) are lost, yet *Laërtius*, who had read them, and *Porphry* and *Jamblichus*,

(t) Two very considerable Writers of *Pythagoras's* Life.

chus, Men of great Reading, and diffuse Knowledge, who, after *Diogenes*, wrote the Life of the same *Pythagoras*, would not have omitted any material Thing of that kind, if they had any where met with it.

(u) Pag.
15.

Amongst his other Journies, Sir *William Temple* mentions *Pythagoras's* Journey to *Delphos* (u). Here, by the by, I must beg leave to put Sir *William Temple* in mind of a small Mistake that he commits in the Word *Delphos*, both here, and pag. 13. when he speaks of *Thales*. In both Places he says that *Pythagoras* and *Thales* travelled to *Delphos*: He might as well have said, that they travelled to *Ægyptum*, and *Phœniciam*, and *Cretam*. It should be printed therefore, in his next Edition, to *Phœnicia*, and *Delphi*: For the *English* use the Nominative Cases of old Names, when they express them in their Mother Tongue. But setting that aside, what this makes to his purpose, is not easie to guess. *Apollo's* Priestesses are not famous for discovering Secrets in Natural or Mathematical Matters; and as for Moral Truths, they might as well be known without going thither to fetch them. *Van Daleu*, in his Discourses of the Heathen Oracles, has endeavoured to prove, that they were only

only Artifices of the Priests, who gave such Answers to Enquirers as they desired, when they had either Power or Wealth to back their Requests. If *Van Daleu's* Hypothesis be admitted, it will strengthen my Notion of *Pythagoras* very much; since when he did not care to live any longer in *Samos*, because of *Polycrates's* Tyranny, and was desirous to establish to himself a lasting Reputation for Wisdom and Learning amongst the ignorant Inhabitants of *Magna Græcia*, where he settled upon his Retirement, he was willing to have them think that *Apollo* was of his Side. That made him establish the Doctrine of Transmigration of Souls, which he brought with him out of *India*, that so those *Italians* might think that he had a certain Reminiscence of Things past, since his first Stage of Life, and the Beginning of the World; and upon that Account admire him the more: For *Laërtius* (w) says, that he pretended to remember every Thing that he had done formerly, whilst he was in those other Bodies; and that he received this as an especial Favour from *Mercury*, who gave him his Choice of whatsoever he desired, except Immortality. (x) Hence also he obliged his Scholars to go through a Trial of Five Years, to learn

(w) *Vita*
Pythag.
§. 4.

(x) *Ibid.*
§. 10.

(y) Pag.
53.

learn Obedience by Silence : And that afterwards it was granted to some few, as a particular Favour, to be admitted into his Presence. These Things tended very much to impress a Veneration of his Person upon his Scholars, but signified nothing to the Advancement of Learning ; yea, rather hindred it. Those that live in the End of the World, (y) when every Thing, according to Sir *William Temple*, is in its Declension, know no Way so effectual to promote Learning, as much Conversation and Enquiry ; and, which is more, they have no *Idea* how it can be done without them. The Learned Men of the present Age pretend to no Acquaintance with *Mercury* or *Apollo*, and can do as little in Natural Knowledge by such a Sham-Revelation, as they can by Reminiscence. If a Man should, for Five Years together, read Lectures, to one that was not allowed to make Pauses, or ask Questions ; another Man, in the ordinary Road, by Books and Professors, would learn more, at least, to much better purpose, in Six Months, than he could in all that Time.

Pythagoras was, without question, a wise Man, well skilled in the Arts of Civil Prudence ; by which he appeased great Disturbances in those *Italian* Common-

monwealths : He had much more Knowledge, than any Man of that Age in *Italy*, and knew how to make the most of it. He took great Delight in Arithmetical Speculations, which, as *Galileo* (2), not (1) Sy-
improbably, guesses, he involved in My- stem. Cos-
steries, that so ignorant People might mic.
not despise him for busying himself in such abstruse Matters, which they could not comprehend ; and if they could have comprehended, did not know to what Use to put them. He took a sure Way to have all his Studies valued, by obliging his Scholars to resign up their Understandings to his Authority and Dictates. The great Simplicity of his Manners, with the Wisdom of his Axioms and Symbols charmed an ignorant Age, which found real Advantages by following his peaceful Measures ; much above those that were formerly procured by Rapin and Violence. This seems to be a true Account of *Pythagoras*, in the History of whose Reputation, there is nothing extraordinary, since Civilizers of Nations have always been as much magnify'd as the Inventors of the most useful Arts : But one can no more conclude from thence, That *Pythagoras* knew as much as *Aristotle* or *Democritus*, than that *Friar Bacon* was as great a Mathematician as

Dr. *Barrow*, or Mr. *Newton*, because he knew enough to be thought a Conjuror in the Age in which he lived, and no despicable Person in any other.

But it may not be amiss to give a Taste of some of the *Pythagorean* Notions; such, I mean, as they first started in *Europe*, and chiefly valued themselves upon. Of this Sort, were their Arithmetical Speculations. By them they pretended to explain the Causes of Natural Things. The following Account of their Explication of Generation is taken out of *Censorinus* and *Aristides*.

‘ Perfect Animals are generated in two
 ‘ distinct Periods of Time; some in Seven
 ‘ Months, some in Nine. Those Generations that are compleated in Seven
 ‘ Months proceed in this Order: In the
 ‘ First Six Days after Conception the
 ‘ Humour is Milky; in the next Eight
 ‘ it is turned into Blood; which Number
 ‘ 8 bears the Proportion of $1\frac{1}{3}$ to 6; in
 ‘ Nine Days more it becomes Flesh; 9 is
 ‘ in a Sescuple Proportion to 6; in Twelve
 ‘ Days more the Embryo is formed; 12
 ‘ is double to 6: Here then are these Stages, 6, 8, 9, 12; 6 is the First perfect
 ‘ Number, because it is the Sum of 1, 2,
 ‘ 3, the only Numbers by which it can
 ‘ be divided: Now if we add these Four
 ‘ Numbers

‘ Numbers 6, 8, 9, 12 together, the
 ‘ Sum is 35, which multiply’d by 6 makes
 ‘ 210, the Number of Days from the
 ‘ Conception to the Birth; which is just
 ‘ Seven Months, allowing 30 Days to a
 ‘ Month. A like Proportion must be ob-
 ‘ served in the larger Period of Nine
 ‘ Months, only 10 the Sum of 1, 2, 3, 4
 ‘ added together, must be added to 35,
 ‘ which makes 45; that multiply’d by 6
 ‘ gives 270, or Nine Times 30, the Num-
 ‘ ber of Days in larger Births.

If these fine Notions are compar’d with
 Dr. *Harvey*’s upon the same Subject, no
 doubt but we shall all be Converts to Sir
William Temple’s Opinion, and make a
 vast Difference between the poor Obser-
 vations of these later Ages, and the sub-
 lime Flights of the Ancients.

Now tho’ abstracted Mathematical
 Theories, which cannot be relished by
 one that has not a tolerable Skill in Ma-
 thematicks before, might, perhaps, pru-
 dently be concealed from the Vulgar, by
 the *Pythagorean* School; and in their
 Stead, such grave Jargon as this imposed
 upon them; yet even that shews how lit-
 tle Knowledge of Nature they could pre-
 tend to. Men that aim at Glory, will
 omit no probable Methods to gain it,
 that lie in their Way; and solid Discove-

ries of a real Insight into Nature, would not only have been eternally true, but have charmed Mankind at another Rate, than such dry sapless Notions as seem at first View to have something of Subtilty; but upon a Second Reflection, appear vain and ridiculous.

(a)pag.28. From *Pythagoras* I shall go on to the Ancient Sages (a), who were so learned in natural Philosophy, that they foretold not only Eclipses in the Heavens, but Earthquakes at Land, and Storms at Sea, great Droughts, and great Plagues, much Plenty or much Scarcity of certain Sorts of Fruits or Grain, not to mention the magical Powers attributed to several of them, to allay Storms, to raise Gales, to appease Commotions of People, to make Plagues cease.

One of the ancientest of these was *Thales*. He was so deeply skilled in Astronomy, that by the Sun's Annual Course he found out the Equinoxes and Solstices. He is said also first to have foretold Eclipses; some Geometrical Properties of Scalene Triangles are ascribed to him, and challenged by *Euphorbus*: Nice we are sure they were not, because the Theorem of *Pythagoras* was not then found out.

When Sir *William Temple* extolled the Skill of these Ancient Sages, in foretelling Change of Weather, he seems to have forgot

forgot that he was in *England*, and fancied that these Old Philosophers were there too. The Climates of *Asia Minor*, and *Greece*, are not so various as ours; and at some stated Times of the Year, of which the recurrent Winds give them constant Warning, they are often troubled with Earthquakes, and always with violent Tempests: So that by the Conjectures that we are here able to make of the Weather at some particular Seasons, though we labour under so great Disadvantages, we may easily guess how much certainer Predictions may be made by curious Men in serener and more regular Climates; which will take off from that Admiration, that otherwise would be paid to those profound Philosophers, even though we should allow that all those Stories which are told of their Skill are exactly true.

Besides, there is Reason to believe that we have the Result of all the Observations of these Weather-wise Sages in *Aratus's Diosemia* and *Virgil's Georgic's*; such as those upon the Snuffs of Candles, the croaking of Frogs, and many others quite as notable as the English Farmer's *Living Weather-Glass*, his *Red Cow that prick'd up her Tail*, an Infallible Presage of a coming Shower.

Sir *William Temple's* Method leads me now to consider, what Estimate ought to be made of the Learning of those Nations, from which he derives all the Knowledge of these Ancient *Greeks*: I shall only therefore give a short Specimen of those Discoveries, with which these Ancient Sages enriched the Ages in which they lived, as I have already done of the *Pythagoreans*, and then proceed.

Diogenes Laërtius informs us of *Empedocles's* (b) Skill in Magick, by the Instance of his stopping those pestilential Vapours that annoy'd his Town of *Agri-*
gentum. He took some Asses, and flea'd them, and hung their Hides over those Rocks that lay open to the *Etesian* Winds, which hindred their Passage, and so freed the Town. He tells another Story of

(c) *Vit. Democritus* (c), That he was so nice in his Observations, that he could tell whether a Young Woman were a Virgin, by her Looks, and could find it out, though she had been corrupted but the Day before; and he knew by looking upon it, that some Goats Milk that was brought him, was of a Black Goat that had had but one Kid.

These are Instances very seriously recorded by grave Authors of the *Magical Wisdom* of the Ancients; that is, as
 Sir

Sir William Temple defines it, of that
(d) *excelling Knowledge of Nature, and* (d) Pag. 46.
*the various Powers and Qualities in its se-
veral Productions, and the Application of
certain Agents to certain Patients, which
by Force of some peculiar Qualities, produce
Effects very different from what fall under
vulgar Observation and Comprehension.*

CHAP. IX.

*Of the History and Mathematicks of
the Ancient Egyptians.*

FROM these *Ancient Sages* Sir William
Temple goes to the Nations, from
which they received their Knowledge,
which are, *Egypt, Chaldea, Arabia, India*
and *China*; only he seems to invert the
Order, by pretending that *China* and *In-
dia* were the Original Fountains from
which Learning still ran Westward; I
shall speak of them in the Order in which
I have named them, because the Claims
of the *Egyptians* and *Chaldeans* having a
greater Foundation in Ancient History,
deserve a more particular Examination.

It must be owned, That the Learning
which was in the World before the Gre-

cian Times was almost wholly confined to the *Egyptians*, excepting what was amongst the *Israelites*: And whosoever does but consider how difficult it is to lay the first Foundations of any Science, be they never so small, will allow them great Commendation; which if the Advocates for them had been contented with, there had been an End of the Controversie. Instead of that, all that has since been added to their Foundations, has been equally challenged as originally due to them, or at least once known by them, by (e) *Olaus Borrichius*, and several others long before Sir *William Temple*, wrote upon this Argument.

(e) In Her-
mete Æ-
gyptio.

Before I enter upon this Question, I shall desire that one Thing may be taken Notice of; which is, That the *Egyptians* anciently pretended to so great Exactness, that every Failure is more justly imputable to them, than to other Nations; not only their History was so carefully look'd after, that there was a College of Priests set up on purpose, whose chief Business it was successively to preserve the remarkable Matters of Fact that occurred in their own Ages, and transmit them undisputed to Posterity, but also, there was answerable Care taken to propagate and preserve all other Parts of useful Learning:

Learning: All their Inventions in *Physick*, in *Mathematicks*, in *Agriculture*, in *Chymistry*, are said to have been inscribed on Pillars, which were preserved in their Temples; whereby not only the Memory of the things themselves was less liable to be lost; but Men were further encouraged to use their utmost Diligence in finding out things that might be of publick Advantage, when they were certain of getting Immortality by these Inventions. This generous Custom was the more to be applauded, because every Man was confined to one particular Part of Learning, as his chief Business; that so nothing might escape them. One was Physician for the *Eyes*, another for the *Heart*, a Third for the *Head* in general, a Fourth for *Chirurgical* Applications, a Fifth for *Womens Diseases*, and so forth. *Anatomy*, we are told, was so very much cultivated by the Kings of *Egypt*, that they particularly ordered the Bodies of dead Men to be opened, that so *Physick* might be equally perfect in all its parts. Where such Care has been used, proportionable Progresses may be expected, and the World has a Right to make a Judgment not only according to what is now to be found, but according to what might have been found, if these Accounts had been really true. In

In the first Place therefore, we may observe, That *the Civil History of Egypt* is as lamely and as fabulously recorded as of any Nation in the Universe: And yet, the *Egyptians* took more than ordinary Care to pay all possible Honours to the Dead, especially their Kings; by preserving their Bodies with Bitumen and refinous Drugs, and by building sumptuous Monuments to lay them in: This certainly was done to perpetuate their Memories, as well as to pay them Respect: It was at least as Ancient as *Joseph's* Time; how much older we know not. The *Jews*, who for another and a more sacred Reason, took care of their Dead, took equal Care to preserve their Genealogies, and to draw an Uniform Thread of their History from *Abraham* down to the Destruction of the Second Temple. Herein they acted consistently, and their History is a standing Instance of this their Care; whereas the *Egyptian* History is so very inconsistent a Business, that it is impossible to make a coherent Story out of it: Not for Want of Materials, but because their Materials neither agree with themselves, nor with the History of any other Nation in the World.

A more certain Proof of the Deficiency of the *Egyptian* History cannot be produced, than that the *Time of the building of the Pyramids* was lost when *Herodotus* ; was in *Egypt* ; as also the *Aera* of the only great Conquerour of that Nation, *Sesostris*. The first of these is not slightly to be passed over. Such vast Fabricks could not be raised without Numbers of Hands, and a great Expence of Time and Money, or something equivalent. *The Traditions* of their Erection are indeed minutely enough set down in *Herodotus* ; but then they are set down as *Traditions* ; and which is more, they are solely to be found in him, though he is not the only ancient Writer that mentions the Pyramids ; he only names *Cheops* and *Mycerinus*, who are differently named by other Historians ; and the Time when they lived, is as little agreed upon, as the Names by which they are called. The History of a Nation can sure be worth very little, that could not preserve the Memory of the Names at least, if not the Time, of those Princes, who were at so much Pains to be remembred, in a Place where their Monuments were so very visibler, that no Person could ever fail up and down the *Nile*, to or from their capital City *Memphis*, without taking Notice of them ; and every
Man

Man upon his first seeing of them would naturally ask, what they were, by whom, and for what Intent erected. To which we may add, that these very Buildings are more exactly described in Mr. Greaves's *Pyramidographia*, than in any ancient Author now extant.

The Difficulty of determining the Age when *Sesostris* lived, is another Instance of the Carelesness of the *Egyptian* Historians. Either he was the same with *Sheshak*, who invaded *Judaea* in *Rehoboam's* Time, as Sir *John Marsham* (f) asserts after *Josephus*, or not: If he was, his Time is known indeed, but then the Authority of *Manetho*, and of those Pillars from which *Manetho* pretended to transcribe the Tables of the several Dynasties of the *Egyptian* Kings, is at an End; besides, it contradicts all the *Greek* Writers that mention *Sesostris*, who place him in their fabulous Age, and generally affirm, that he lived before the Expedition of the *Argonauts*, which preceded the War of *Troy*. If he was not that *Sheshak*, then the Time when the only famous Conqueror of the *Egyptian* Nation lived is uncertain, and all that they know of him is, that *once upon a time* there was a mighty King in Egypt, who conquered *Ethiopia*, *Arabia*, *Assyria* and up to *Colchis*,

(f) In Canon
none Chrono-
nico.

chis, with *Asia* the Less, and the Islands of the *Ægean* Sea, where having left Marks of his Power, he returned home again to reap the Fruits of his Labours: A Tradition which might have been preserved without setting up a College at *Heliopolis* for that Purpose.

The very learned Mr. *Dodwell* in his Discourse concerning the Phœnician History of Sanchoniathon, advances a Notion which may help to give a very probable Account of those vast Antiquities of the *Egyptians* pretended to by *Manetho*. He thinks that after the History of *Moses* was translated into *Greek*, and so made common to the learned Men of the neighbouring Nations, that they endeavoured to rival them by pretended Antiquities of their own, that so they might not seem to come behind a People, who till then had been so obscure. This, though particularly applied by Mr. *Dodwell* to Sanchoniathon's History, seems equally forcible in the present Controversie: For *Manetho* dedicated his History to *Ptolemee Philadelphus*, at whose Command it was written, and wrote it about the Time that the LXXII Interpreters translated the *Pentateuch*. The great Intercourse which the *Egyptians* and *Israelites* formerly had each with other, made up a considerable part

part of that Book, and occasioned its being the more taken Notice of; so that this History being injurious to the vain pretences of that People, might very probably provoke some that were jealous for the Honour of their Nation, and *Manetho* amongst the rest, to set up an Anti-History to that of *Moses*; and to dedicate it to the same Prince who employed the *Jews* to translate the *Pentateuch*, and who ordered *Manetho* himself to bring him in an Account of the *Egyptian* Antiquities, that so any Prejudices which *Ptolemee*, who was of another Nation himself, might entertain against their Country, might be effectually removed.

This Notion is the more probable in our Case, because it equally holds, whether we follow Sir *John Marsham's* Accounts, who has made the *Egyptian* Antiquities intelligible; or whether they are left in the same Confusion that they were in before. That most Learned Gentleman has reduced the wild Heap of *Egyptian* Dynasties into as narrow a Compass as the History of *Moses*, according to the *Hebrew* Account, by the help of a Table of the *Theban* Kings, which he found under *Eratosthenes's* Name, in the Chronography of *Syncellus*. For, by that Table he 1. Distinguished the Fabulous and Mystical

Mystical Part of the *Egyptian* History, from that which seems to look like Matter of Fact. 2. He reduced the Dynasties into Collateral Families, reigning at the same time, in several Parts of the Country; which, as some learned Men saw before, was the only Way to make those Antiquities consistent with themselves, which till then were confused and incoherent. But it seems evident by the Remains that we have of *Manetho* in *Eusebius*, and by the Accounts which we have of the *Egyptian* History in *Josephus's* Books against *Appion*, and in the Ancient *Christian* Writers, that the *Egyptians* in *Ptolemee's* Time did not intend to confine themselves within the Limits set by *Moses*, but resolved to go many Thousand Years beyond them. If therefore *Eratosthenes's* Table be genuine, not only *Manetho's* Authority sinks, but the Pillars from whence he transcribed his Tables of the Kings of their several Dynasties are Impostures, since they pretend to give successive Tables of vast Numbers of Kings reigning in several Families, for many Ages; which ought to be contracted into a Period of Time, not much exceeding Two Thousand Years. If the Table of *Eratosthenes* be not the true Rule by which the *Egyptian* Antiquities are to be squared,

squared, then the former Prejudices will return in full force ; and one cannot value *Tables*, and *Pillars*, and *Priests*, that could not fix *the Time of the Erection of the Pyramids*, and *the Age of Sesostris*, so certainly, as that when *Herodotus* was in the Country, they might have been able to inform him a little better than they did.

This long Enquiry into the *Egyptian* History will not, I hope, be thought altogether a Digression from my Subject, because it weakens the *Egyptians* Credit in a very sensible Part : For, if their Civil History is proved to be egregiously fabulous, or inconsistent, there will be no great Reason to value their mighty Boasts in any thing else ; at least, not to believe them upon their own Words, without other Evidence.

In *Mathematicks*, the *Egyptians* are, of all Hands, allowed to have laid the first Foundations : The Question therefore is, how far they went. Before this can be answered satisfactorily, one ought to enquire whether *Pythagoras* and *Thales*, who went so far to get Knowledge, would not have learnt all that the *Egyptians* could teach them : Or whether the *Egyptians* would willingly impart all they knew. The former, I suppose, no Body
questions :

questions: For the latter, we are to distinguish between Things that are concealed out of Interest, and between other things, which, for the same Interest, are usually made publick. *The Secrets of the Egyptian Theology* were not proper to be discovered, because by those Mysteries they kept the People in awe: *The Philosopher's Stone* likewise, if they had been Masters of it, might, for Gain, have been concealed: And *Medicinal Arcana* are of Advantage oftentimes to the Possessors, chiefly because they are *Arcana*. But *Abstracted Mathematical Theories*, which bring Glory to the Inventors when they are communicated to those that can relish them, and which bring no Profit when they are locked up, are never concealed from such as shew a Desire to learn them; provided that by such a Discovery the first Inventors are not deprived of the Glory of their Inventions; which is increased by publishing, if they have before-hand taken Care to secure their Right. So that we may reasonably conclude, that when *Pythagoras* is commended for no famous Invention in Geometry, except the 47th. Proposition of the First Book of *Euclid*, that he brought nothing of more Moment, in that Way, with him, out of *Egypt*; and therefore, either the further

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Discoveries that were made in Geometry, were made by the *Egyptians* afterwards; or, which is more probable, they were *Grecian* Superstructures upon those Foundations. Besides, though a Man travelled into *Egypt*, yet it does not follow from thence that he learnt all his Knowledge there. So that though *Archimedes* and *Euclid* were in *Egypt*, yet they might, for all that, have been Inventors themselves of those noble Theorems which are in their Writings. In *Archimedes's* Time *Greeks* lived in *Alexandria*; and the Learning of *Egypt* could no more at that time be attributed to the old *Egyptians*, than the Learning of Archbishop *Usher*, Sir *James Ware*, and Mr. *Dodwell*, can be attributed to a Succession of those learned *Irish-men* who were so considerable in the *Saxon* Times.

This last Consideration is of very great Moment; for few of the *Greeks*, after *Plato*, went into *Egypt* purely for Knowledge; and though *Plato* brought several of his Notions out of *Egypt*, which he interwove into his Philosophy, yet the Philosophers of the *Alexandrian* School, who, for the most part, were *Platonists*, shew by their Way of Writing, and by their frequent Citations out of *Plato's* Books, that they chose to take those Things

Things from the *Grecians*, which one would think might have been had nearer home, if they had been of the Original Growth of the Country. The most considerable Propositions in *Euclid's* Elements were attributed to the *Greeks*; and we have nothing confessedly *Egyptian*, to oppose to the Writings of *Archimedes*, *Apolonius Pergæus*, or *Diophantus*: Whereas, had there been any Thing considerable, it would most certainly have been produced, or, at least, hinted at, by some of those very learned *Egyptians*, or rather later *Greeks* born in *Egypt*; whose Writings that treat of the Extent of the *Egyptian* Knowledge, are still extant.

Having now examined the *History* and *Geometry* of the *Egyptians*, it will be much easier to go through their Pretences, or rather the Pretences of their Advocates, to Superiority in other Parts of Learning. The *Egyptians* seem to have verified the Proverb, *That he that has but one Eye, is a Prince among those that have none.* This was Glory enough; for it is always very honourable to be the First, where the Strife is concerning Things which are worth contending for.

CHAP. X.

Of the Natural Philosophy, Medicine and Alchemy of the Ancient Egyptians.

THE *Egyptian Natural Philosophy* and *Physick* shall be joined together, because there is so great an Affinity between them, that true Notions in either Science assist the other. Their *Physick*, indeed, was very famous in *Homer's* Time: And wonderful Things are told of *Hermes*, the pretended Father of the Chymical Art. But one ought to distinguish between particular Medicines, how noble soever, and general Theories founded upon a due Examination of the Nature of those Bodies from whence such Medicines are drawn, and of the Constitution and Fabrick of the Bodies of the Patients to whom they are to be applied, and of the incidental Circumstances of Time and Place; which are necessary to be taken in by a wise Physician. The Stories of the *West-Indian* Medicines are many of them very astonishing; and those Salvages knew perfectly how to use them, and yet they were never esteemed able
Phy-

Physicians. This Instance is applicable to the present Question: *Galen* often mentions *Egyptian* Remedies in his Treatises of *Medicines*, which are numerous and large, yet he seldom mentions any of their Hypotheses, from which only a Man can judge whether the *Egyptians* were well-grounded Physicians, or Empiricks. This is the more remarkable, because *Galen* had lived long at *Alexandria*, and commends the Industry of the *Alexandrians* in cultivating Anatomy, which is so necessary a Part of a Physician's Business.

In general therefore we may find, that all the *Egyptian* Notions of *Physical* Matters were built upon *Astrological* and *Magical* Grounds: Either the Influence of a particular Planet, or of some tutelar Dæmon were still considered. These Foundations are precarious and impious, and they put a Stop to any Increase of real Knowledge, which might be made upon other Principles. He that minds the Position of the Stars, or invokes the Aid of a Dæmon will rarely be solicitous to examine nicely into the Nature of his Remedies, or the Constitution of his Patients, without which none of the ancient rational Physicians believed that any Man could arrive at a perfect Knowledge of their

(h) De Hermetica Ægyptiorum vetere & Paracelsicorum nova Medicinâ.

Art. So that if *Hippocrates* learn'd his Skill in *Egypt*, as it is pretended, the *Egyptian* Physicians afterwards took a very stupid Method to run upon imaginary Scents, so far as even to lose the Memory that they had ever pursued more rational Methods. Those that would be further satisfied of the Truth of this Matter of Fact, may find it abundantly proved in *Conringius's* Discourse of the old *Egyptian* Medicine (h).

But we are told, that there was a particular sort of Physick, used only amongst the *Egyptian Priests*, which was kept secret, not only from the *Greeks* that came into their Country for Knowledge, but from the Generality of the Natives themselves; wherein, by the Help of the *Grand Elixir*, they could do almost any thing but restore Life to the Dead. This *Elixir*, which was a Medicine made with the Philosophers Stone, was a Chymical

(i) De Ortu & Progressu Chemiæ; as also Hermetis Ægyptiorum & Chemicorum sapientia ab Herm. Conringii Animadversionibus vindicata.

Preparation: And if we may believe *Olaus Borrichius* (i), the Great and Learned Advocate of the Chymical and Adept Philosophers, was the Invention of *Hermes*, who was contemporary with *Isis* and *Osiris*, whose Age none ever yet determined. If these Claims are true, there is no Question but the

the *Egyptians* understood Nature, at least that of Metals, in a very high Degree. This is an *Application of Agents to Patients* (k), which, if made good, will go farther than any Assertion commonly brought to prove the extent of *Egyptian* Knowledge: And therefore, I presume, I shall not be thought tedious if I enlarge more particularly upon this Question, than I have done upon the rest; especially since there has not been, that I know of, any direct Answer ever Printed to *Borrichius's* Book upon this Argument, which he wrote against the forementioned Discourse of *Conringius*.

One may justly wonder that there should have been so noble an Art as that of turning baser Metals into Gold and Silver so long in the World, and yet that there should be so very little, if any thing, said of it in the Writings of the Ancients. To remove this Prejudice therefore, all the fabulous Stories of the *Greeks* have, by Men of fertile Inventions, been given out to be disguised Chymical *Arcana*. *Jason's Golden Fleece*, which he brought from *Colchis* was only a Receipt to make the *Philosopher's Stone*, and *Medea* restored her Father-in-Law, *Aeson*, to his Youth again by the Grand *Elixir*. *Borrichius* is very confident that the *Egyptian* Kings

built the Pyramids with the Treasures that their Furnaces afforded them, since if there were so many Thousand Talents expended in Leeks and Onions, as *Herodotus* tells us there were, which must needs have been an inconsiderable Sum in Comparison of the whole Expence of the Work, one cannot imagine how they could have raised Money enough to defray the Charge of the Work any other Way. And since *Borrichius*, *Jacobus Tollius* has set out a Book called *Fortuita*, wherein he makes most of the Old Mythology to be Chymical Secrets.

But though *Borrichius* may believe that he can find some obscure Hints of this Great Work in the Heathen Mythologists, and in some scattered Verses of the Ancient Poets, which according to him they themselves did not fully understand when they wrote them; yet this is certain, That the ancientest Chymical Writers now extant, cannot be proved to have been so old as the Age of *Augustus*. *Conringius* believes that *Zosimus Panopolita* is the oldest Chymical Author that we have, whom he sets lower than *Constantine the Great*. That perhaps may be a Mistake; for *Borrichius*, who had read them both in MS. in the French King's Library, brings very plausible Arguments to prove that

that *Olympiodorus*, who wrote Commentaries upon some of the Chymical Discourses of *Zosimus*, was 150 Years older than *Constantine*, because he mentions the *Alexandrian* Library in the Temple of *Serapis*, as actually in being, which in *Ammianus Marcellinus*'s Time, who was contemporary with *Julian* the Apostate, was only talked of, as a thing destroyed long before. I don't mean that which was burnt in *Julius Caesar*'s Time, but one afterwards erected out of the scattered Remains that were saved from that great Conflagration, which is mentioned by *Tertullian*, under the Name of *Ptolemee*'s Library at *Alexandria*. If this *Zosimus* is the same whom *Galen* mentions, for a Remedy for sore Eyes, in his 4th. Book of *Topical Medicines*, then both he and *Olympiodorus* might have been considerably older; and yet have lived since our Blessed Saviour's Time. However, be their Age what it will, they wrote to themselves, and their Art was as little known afterwards as it was before; *Julius Firmicus* is the First Author that has mentioned *Alchemy*, either by Name, or by an undisputed Circumlocution; and he dedicated his Book of *Astrology* to *Constantine the Great*. *Manilius* indeed (who is supposed to have lived in *Augustus*'s Time) in

in the 4th. Book of his *Astronomicon*, where he gives an Account of those that are born under *Capricorn*, has these Words,

————— *scrutari cæca metalla,
Depositas & opes, terræq; exuere venas,
Materiemq; manu certâ duplicarier arte:*

which last Verse seems to be a Description of *Alchemy*: But besides that, the Verse is suspected to be spurious; even the Age of *Manilius* himself is not without Controversie; some making him contemporary with the Younger *Theodosius*, and consequently later than *Firmicus* himself. We may expect to have this Question determined, when my most Learned Friend Mr. Bentley shall oblige the World with his *Censures* and *Emendations* of that Elegant Poet.

But if these *Greecian* Chymists have the utmost Antiquity allowed them that *Borrichius* desires, it will signifie little to deduce their Art from *Hermes*, since Men might pretend that their Art was derived from him in *Zosimus's* Days, and yet come many Thousand Years short of it, if we follow the Accounts of *Manetho*. Wherefore, though this is but a negative Argument, yet it seems to be unanswerable, because if there had been such an Art,
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some of the *Greeks* and *Romans*, who were successively Masters of *Egypt*, would have mentioned it at least, before *Zosimus's* Time. Such a Notice whether with Approbation, or Contempt, had been sufficient to ascertain the Reality of such a Tradition. *Tacitus* (l) tells us that *Nero* (l) Annal. Lib. XVI. sent into *Africa* to find some Gold, that was pretended to be hid under Ground: This would have been an excellent Opportunity for him to have examined into this Tradition, or to have punished those, who either falsely pretended to an Art which they had not, or would not discover the true Secret; which in his Opinion would have been equally criminal; and had *Nero* done it, *Pliny* would have told us of it, who was very inquisitive to collect all the Stories he could find of every thing that he treats about, whereof Gold (m) (m) Nat. Hist. Lib. XXXIII. cap. 1, 2, 3, 4. is one that is not slightly passed over; and besides, he never omits a Story because it appears strange, and incredible, if we may judge of what he has left out, by what he has put in, but often ranges the wonderful Qualities of natural Bodies under distinct Heads, that they might be the more observed.

To evade the Force of this Argument, *Borrichius* (n) says that the *Egyptians* (n) Herm. Egypt. were afraid of their Conquerours, and so industriously

industriously concealed their Art. But there is a wide Difference between concealing the Rules and Precepts of an Art, and concealing the Memory that ever there was such an Art. If it was ever known before the *Persian* Conquest, as by his Account of the Erection of the Pyramids, which were built many Ages before *Cambyse's* Time, it is plain he believes it was, though we should allow it to have been in few Hands, it is not credible that this Art of making Gold should never have been pretended to before *Dioclesian's* Time, who is reported by *Suidas* to have burnt great Numbers of Chymical Book, which gave an Account of the Process. Whereas afterwards, ever now and then, Footsteps of cheating *Alchemists* are to be met with in the *Greek* Historians. It was not possible to pretend to greater Secrecy in the Manner of their Operations, than is now to be found in all the Writings of Modern Adept Philosophers (as they call themselves.) And yet these Men, who will not reveal their Process, would think themselves affronted, if any Man should question the real Existence of their Art.

But the Hypothesis of those who find Chymical Secrets in *Homer*, *Virgil*, and the rest of the ancient Poets, is liable to several

Several Exceptions taken Notice of neither by *Conringius* nor *Borrichius*.

1. They say that when *Jason* heard that the King of *Colchis* had a Book writ upon a Ram's-skin, wherein was the Process of the Philosopher's Stone, he went with the *Argonauts* to fetch it. Here it may be objected, 1. That it is not likely that *Sesostris*, who conquered *Colchis*, would ever suffer the *Egyptian* Priests to reveal such a Secret to that conquered People. *Dioclesian* according to them burnt all the Chymical Books that he could find in *Egypt*, that the *Egyptians* might not rebel, when they were deprived of that Fund, which supported their Wars. And *Borrichius* supposes that the *Egyptian* Priests used this Art chiefly to supply the Expences of their Kings. 2. How came *Jason* and the *Argonauts* not to grow richer by this Fleece? It cannot be pretended that it was concealed from them, because it was like the Books of the Modern *Adepti*, written in so obscure a Stile, that it was unintelligible for want of a Master; since *Medea* was with *Jason*, who had the Secret, what or how great soever it was. 3. Since the *Grecians* were not tied to Secrecy, how came their Traditions to be so obscure, that those Passages in *Apollonius Rhodius's Argonauticks* which

which are supposed to be meant of the *Grand Elixir*, were never applied to a Chymical Sense, till the Writings of *Synesius*, *Zosimus*, and the other old *Grecian* Chymists appeared? Especially since, 4. *Apollonius Rhodius* himself was an *Alexandrian Greek*, born in *Egypt*, and so could easily acquaint himself with the Traditions of that Country, which he, originally of another Nation, was under no Obligation to conceal.

2. The Chymists, at least *Borrichius* for them, own *Democritus's* Books to be genuine, upon the Credit of *Zosimus* who quotes them: If they are, this pretended Secrecy falls to the Ground: For *Democritus* affirms, That he learnt his Art from *Ostanes* a *Mede*, who was sent by the Kings of *Persia* into *Egypt*, as Governour of the *Egyptian* Priests. Then the Secret was divulged to some of the Conquerours of their Country. If so, why no more Tradition of it? If not the Process it self, yet at least the Memory that once there was such a Process? Which would have been enough for this Purpose. The same Question may be asked of *Democritus*, to whom *Ostanes* revealed it. This will weaken *Zosimus's* Credit as an Antiquary, upon whose Assertion most of this pretended Antiquity
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is founded. Since at the same Time that he objects the Secrecy of the ancient *Egyptian* Priests, as a Reason why the Memory of this Art was so little known, he owns himself obliged to a *Greek*, who had it from the *Egyptians* at Second Hand.

But how will these Pretenders to remote Antiquity, who tell us, that *Moses*, by his Skill in Chymistry, ground the Golden Calf to Powder, reconcile a Passage in *Theophrastus* to their Pretensions?

He, speaking of Quicksilver (o), says that the Art of extracting it from *Cinnabar*

(o) Lib.
de Lapidibus.

was not known till 90 Years before his Time, when it was first found out by *Callias* an *Athenian*. Can we think that the *Egyptians* could hinder these inquisitive *Grecians*, who staid so long in their Country, from knowing that there was such a Metal as *Mercury*? Or could these *Egyptians* make Gold without it? If they could, they might reasonably suppose that the *Israelites* could make Brick without Straw, since they could make Gold and Silver without that, which Modern *Adepts* affirm to be the Seed of all Metals. *Theophrastus*'s Words are too general, to admit of an Objection, as if he believed that *Callias*'s Invention ought to be limited to his own Country. This, join'd
to

to the great Silence of the Ancients, especially *Herodotus* and *Diodorus Siculus*, who dwell so long upon the *Egyptian* Arts and Learning, concerning most of the wonderful *Phænomena* of that extravagant Metal, plainly shews that there were no Traditions of such mighty things to be done by it, as the *Alchemist's* Books are full of. *Borrichius* therefore recurs to his old Subterfuge, *Egyptian* Secrecy, and finds some doubtful at least, if not fabulous, Stories of *Dædalus*, and *Icarus*, and the Poetical Age, which he opposes to the positive Testimony of *Theophrastus*. Perhaps this may be thought to be begging the Question, since some who have written of the Philosophers Stone, have taught that their *Mercury* has no Affinity with common *Mercury*: Which has led many Persons to try several extravagant Processes to find it out. But *Eireneus Philalethes*, who is look'd upon as one of the clearest Writers that has ever written upon this Subject; says express-

(p) *Enarratio Methodica trium Gebri Medicinarum*, p. 18.

ly that (p) *Natural Mercury Philosophically prepared is the Philosophical Menstruum, and the dissolvent Mercury.*

After so long an Enquiry into the Antiquity of this Art of transmuting Metals, it will be asked perhaps, what may be thought of the Art it self. I must needs say

say, I cannot tell what Judgment to make of it: The Pretences to Inspiration, and that Enthusiastick Cant, which run through the Writings of almost all the *Alchemists*, seem so like Imposture, that one would be tempted to think that it was only a Design carried on from Age to Age, to delude Mankind: and it is not easy to imagine why God should hear the Prayers of those that desire to be rich. If, as they pretend, it was Zeal for the good of Mankind that made them take such Pains to find out such noble Medicines as should free Men from the most obstinate Diseases to which our Natures are subject, why do they not communicate them, and leave the Process in Writing plainly to Posterity, if they are afraid of Danger for themselves: Concern for the Welfare of Mankind and affected Secrecy, seem here inconsistent things: Men of such mortified Tempers, and publick Spirits ought not to be concerned, though Gold or Silver were made as common as Lead, or Tin, provided that the Elixir which should remove all Diseases were once known.

Though these are reasonable Prejudices against the Belief of the Truth of this Operation, yet one can hardly tell how to contradict a Tradition so general,

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and

(q) Vide Borrichium de
Ortu & Progressu Che-
mia, & Morhofii Episto-
lam de transmutatione
Metallorum ad Joëlem
Langelottum.

and so very well attested (q).
So many Men, methinks, could
not have cheated the World
successfully so long, if some
had not been sincere: And, to
use a Proverb in their own

Way, *so much Smoak could scarce have lasted
so long without some Fire.* Till the femi-
nal Principles from which Metals are
compounded, are perfectly known, the
Possibility of the Operation cannot be dis-
proved: Which Principles, as all other
real Essences of things, are concealed
from us. But as a wise Man cannot,
perhaps, without Rashness disbelieve
what is so confidently asserted, so he ought
not to spend much Time and Cost, about
trying whether it will succeed, till some
of the *Adepti* shall be so kind as to give
him the Receipt.

By what has been said it is evident,
what Opinion one ought to have of the
Chymical Skill of the ancient *Egyptians*:
Though it is most probable that the Art
owes its Original to them, from whom it
receives its Name: But this Original is
much too late to do Sir *William Temple's*
Hypothesis any Service.

But it is high Time to leave the *Egyp-
tian Physick*, and therefore, I shall only
add One or Two Instances of their Skill

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in Anatomy, and so pass on. Gellius (r) (r) Noſt.
 and Macrobius (s) observe; the one from Attic. Lib.
 Appion, who wrote of the Egyptians; the X. cap. 10.
 other from the Egyptian Priests themselves, (s) Satur-
 nal. l. 7.
 that there is a particular Nerve that goes cap. 13.
 from the Heart to the little Finger of the
 Left-Hand, for which Reason they al-
 ways wore Rings upon that Finger; and
 the Priests dipped that Finger in their per-
 fumed Ointments; this being ridiculed
 by Corringius, Borrichius (t) assures us (t) Herm.
 that he always found something to coun- Ægypt.
 tenance this Observation upon cutting Præfat.
 of his Nails to the quick: Pliny in the
 37th. Chapter of the 11th. Book of his
 Natural History, and Censorinus in the
 17th. Chapter of his little Book *De Die*
Natali, give this following Reason from
 Dioscorides the Astrologer, why a Man
 cannot live above a Hundred Years, be-
 cause the Alexandrian Embalmers obser-
 ved a constant Increase and Diminution
 of Weight of the Hearts of those sound
 Persons whom they opened, whereby they
 judged of their Age. They found that
 the Hearts of Infants of a Year old weigh-
 ed two Drachms, and this Weight en-
 creased Annually by two Drachms every
 Year till Men came to the Age of Fifty
 Years: At which Time they as gradually
 decreased till they came to an Hundred,

when, for want of a Heart, they must necessarily die.

To these two Instances of the *Criticalness* of *Egyptian Anatomy* I shall add one of *their Curiosities in Natural Enquiries*; and that is, *their Knowledge of the Cause of the Annual Overflowing of the Nile*. This, which was the constant Wonder of the Old World, was a *Phænomenon* seldom over-looked by the *Greek Philosophers*: Seven of whose Opinions are reckoned up by *Plutarch*, in the First Chapter of the Fourth Book of *his Opinions of the Philosophers*. If Curiosity generally attends a Desire of Knowledge, and grows along with it, then the *Egyptian Priests* were inexcusably negligent, that they did not know that the swelling of the *Nile* proceeded from the Rains that fell in *Ethiopia*, which raising the River at certain Seasons, made that overflowing of the Flats of *Egypt*. One would think that in *Sesostris's* Time the *Egyptian Priests* had Access enough into *Ethiopia*; and whoever had once been in that Country could have resolved that Problem, without any Philosophy. It was known indeed in *Plato's* Time, for then the Priests told it to *Eudoxus*; but *Thales*, *Democritus*, and *Herodotus*, who had all enquired of the *Egyptians*, give such uncouth

couth Reasons, as shew that they only spoke by guess. *Thales* thinks that the *Etesian* Winds blew at that Time of the Year against the Mouths of the River, so that the fresh Water finding no Vent, was beaten back upon the Land. *Democritus* supposes that the Northern Snows being melted by the Summer Heats, are drawn up in Vapours into the Air, which Vapours circulating towards the South, are by the Coldness of the *Etesian* Winds condensed into Rain, by which the *Nile* is raised. *Herodotus* thinks that an equal Quantity of Water comes from the Fountains in Summer and Winter, only in Summer there are greater Quantities of Water drawn up by the Sun, and in Winter less, and so by Consequence all that Time it overflowed. *Democritus's* Opinion of the *Phænomenon* seems not amiss, though his Hypothesis of the Cause of it is wrong in all Probability: Yet it is plain, That *Plutarch* did not believe it to be the same with that which the *Egyptian* Priests gave to *Eudoxus*, which is the only true one, because he sets them both down apart. The Cause of this wonderful *Phænomenon* could not be pretended to be a Secret; no Honour could be got by concealing a thing, the pretended Ignorance whereof was rather a

Disgrace. Those *Egyptian* Priests, whose Business it was to gather Knowledge, must have had an extraordinary Love for a sedentary Life, or have been averse to inform themselves from others, more than the rest of Mankind, who would not be at the Pains either to learn what *Sesostris's* Soldiers could have told them, or to go about Two Hundred Miles Southward to search for that, which they must certainly have often *reasoned about*, if they were such Philosophers as they pretended to be.

Nay, by the Curiosity of the *Greeks* we are sure they did *reason about* it; they thought it as much a Wonder as we can do now: Rather more, because they knew of no other Rivers, that overflow at periodical Seasons like it, as some are now known to do in the *East-Indies*.

Upon the whole Matter, after a particular Search into the whole Extent of *Egyptian* Learning, there seems to be no Reason to give the *Egyptians* the Pre-eminence in point of Knowledge above all Mankind. However, considering the great Labour which is requisite to form the First Notions of any part of Learning, they deserve great Applause for what they discovered, and ought to have proportionable Grains of Allowance for what

what they left unfinished : So that when the Holy Scriptures (u) assure us that (u) Acts Mosés was skilled in all the Learning of VII. 22. the Egyptians, they give him the greatest Character for humane Knowledge that could then be given to any Man. The Egyptian Performances in Architecture were very wonderful, and the Character which Hadrian the Emperour gives them, that they found Employments for all Sorts of Persons, the Blind, the Lame, the Gouty, as well as the strong and healthy, shews that it was natural to the Egyptians to be always busied about something useful. The Art of Brewing Mault-drinks was very anciently ascribed (w) to the Egyptians as the first In- (w) Herodotus Columella, Lib. X. ventors, for which these Northern Nations are not a little beholding to them. Their Laws have, by those who have taken the greatest Pains (x) to destroy the (x) Conringius in Medicinâ Hermetica. Reputation of their Learning in other things, been acknowledged to be very wise, and worth going so far as Pythagoras, Solon and Lycurgus did to fetch them. So that if Sir William Temple had extolled their Learning with any other Design than that of disparaging the Knowledge of the present Age, there would have been no Reason to oppose his Assertions.

CHAP. XI.

Of the Learning of the Ancient Chaldeans and Arabians.

THE *Chaldeans* and the *Arabs* are the People that lie next in *Sir William Temple's* Road. We may pronounce with some Certainty, 1. That the *Chaldean* Astronomy could not be very valuable, since, as we know from *Vitruvius*, and others, they had not discovered that the Moon is an Opake Body. Whether their Astronomical Observations were older than their Monarchy, is uncertain: If they were not, then in *Alexander the Great's* Time they could not challenge an Antiquity of above Five or Six Hundred Years. I mention *Alexander*, because he is said to have sent vast Numbers of Observations from *Babylon*, to his Master *Aristotle*. The *Assyrian* Monarchy, of which the *Chaldean* might not improperly be called a Branch, pretends, indeed, to great Antiquity: Great Things are told of *Ninus* and *Semiramis*, who is more than once mentioned by *Sir William Temple*, in these *Essays*, for her Victories, and her Skill in Gardening;

ing; but these Accounts are, very probably, fabulous, for the following Reasons.

Till the Time of *Tiglath-Pileser* and *Pul*, we hear no News of any *Assyrian* Monarchs in the *Jewish* History. In *Amraphel*'s Time, who was overthrown by *Abraham* and his Family, in the Vale of *Siddim*, the Kings of *Chaldea* seem to have been no other than those of *Canaan*, Captains of *Hords*, or Heads of *Clans*: And *Amraphel* was Tributary to *Chedorlaomer* King of *Elam*, whose Kingdom lay to the East of *Babylon*, beyond the River *Tigris*. *Chusban Rishathaim* King of *Mesopotamia*, who was overthrown some Ages after by *Othniel*, the *Israelitish* Judge, does not seem to have been a mighty Prince: It may be said, indeed, that he was General to some *Assyrian* Monarch; but that is begging the Question, since there is nothing which can favour such an Assertion in the Book of *Judges*.

But when the *Assyrians* and *Babylonians* come once to be mentioned in the *Jewish* History, they occur in almost every Page of the *Old Testament*. There are frequent Accounts of *Pul*, *Tiglath-Pileser*, *Shalmanezzer*, *Sennacherib*, *Esar-haddon*, *Nebuchadnezzar*, *Evil-merodach*, *Belsazzar*; and who not? But these Kings lived within

within a narrow Compass of Time ; the oldest of them but a few Ages before *Cyrus*. This would not suit with that prodigious Antiquity which they challenged to themselves. The Truth is, *Herodotus*, who knew nothing of it, being silent, *Ctesias* draws up a new Scheme of History, much more pompous ; and from him, or rather, perhaps, from *Berosus*, who was Contemporary with *Manetho*, and seems to have carried on the same Design for *Chaldea*, which *Manetho* undertook for *Egypt*, *Diodorus Siculus*, *Pompeius Trogus*, *Eusebius*, *Syncellus*, and all the Ancients that take notice of the *Assyrian* History, have afterwards copied.

Ctesias knew he should be straitned to find Employment for so many Kings for Thirteen Hundred Years ; and so he says, they did little memorable after *Semiramis*'s Time. Sir *William Temple* employs them in Gardening. As if it were probable that a great Empire could lie still for above a Thousand Years ; or that no Popular Generals should wrest the Reins out of the Hands of such drowzy Masters in all that Time. No History but this can give an Instance of a Family that lasted for above a Thousand Years, without any Interruption : And of all its Kings, not one is said to reign less than Nineteen, but

but some Fifty five Years. The healthiest Race that ever was heard of; of whom, in Thirteen Hundred Years, not one died an untimely Death. If any Thing can be showed like this in any other History, Sacred or Profane, it will be easie to believe whatsoever is asserted upon this Subject.

If therefore the *Chaldean* Learning was no older than their Monarchy, it was of no great Standing, if compared with the *Egyptian*. The Account of *Nebuchadnezzar's* Dream, in the 2d. Chapter of *Daniel*, shews the *Chaldean* Magick to have been downright Knavery; since *Nebuchadnezzar* might reasonably expect that those should tell him what his Dream was, who pretended to interpret it when it was told them; both equally requiring a super-natural Assistance: Yet there lay their chiefest Strength; or, at least, they said so: Their other Learning is all lost. However, one can hardly believe that it was ever very great, that considers how little there remains of real Value, that was learnt from the *Chaldeans*. The History of Learning is not so lamely conveyed to us, but so much would, in all probability, have escaped the general Ship-wrack, as that, by what was saved, we might have been able to guess at what was lost.

If

If the *Learning* of these *Ancient Chaldeans* came as near *that of the Arabs* as their Countries did, one may give a very good Judgment of its Extent. Sir *William Temple* observes, that Countries little exposed to Invasions, preserve Knowledge better than others that are perpetually harraſſed by a Foreign Enemy; and by Conſequence, whatſoever Learning the *Arabs* had, they kept; unleſs we ſhould ſuppoſe that they loſt it through Careleſneſs. We never read of any Conqueſts that pierced into the Heart of *Arabia the Happy*, *Mahomet's* Country, before the Beginning of the *Saracen* Empire. It is very ſtrange therefore, if, in its Paſſage through this noble Country, inhabited by a ſprightly, ingenious People, Learning, like Quick-Silver, ſhould run through, and leave ſo few of its Influences behind it. It is certain that the *Arabs* were not a learned People when they over-ſpread *Aſia*: So that when afterwards they tranſlated the *Grecian* Learning into their own Language, they had very little of their own, which was not taken from thoſe Fountains. Their *Aſtronomy* and *Aſtrology* was taken from *Ptolemee*, their *Philophy* from *Ariſtotle*, their *Medicks* from *Galen*; and ſo on. *Ariſtotle* and *Euclid* were firſt tranſlated
into

into *Latin*, from *Arabick* Copies ; and those Barbarous Translations were the only Elements upon which the *Western School-men* and *Mathematicians* built. If they learnt any thing considerable elsewhere, it might be *Chymistry* and *Alchemy* from the *Egyptians* ; unless we should say that they translated *Synesius*, or *Zosimus*, or some other *Grecian Chymists*.

Hence it follows, that the *Arabs* borrowed the greatest part, at least, of their Knowledge from the *Greeks*, though they had much greater Advantages of Communicating with the more Eastern Parts of the World, than either *Greeks* or *Romans* ever had. They could have acquainted us with all that was rare and valuable amongst those Ancient Sages. The *Saracen* Empire was under one Head in *Almanzor's* Time ; and was almost as far extended Eastward as ever afterwards. His Subjects had a free Passage, from the *Tagus* to the *Ganges* ; and being united by the common Bond of the same Religion, the *Brachmans*, some of whom did, in all probability, embrace the *Mahometan* Faith, would not be shy of revealing what they knew, to their *Arabian* Masters. By this Means, the Learning of the *Egyptians*, *Chaldeans*, *Indians*, *Greeks* and *Arabs*, ran in one common Channel. For
several

several Ages, Learning was so much in Fashion amongst them, and they took such Care to bring it all into their own Language, that some of the learnedest *Jews*, *Maimonides* in particular, wrote in *Arabick*, as much as in their own Tongue. So that we might reasonably have expected to have found greater Treasures in the Writings of these learned *Mahometans*, than ever were discovered before: And yet those that have been conversant with their Books say, that there is little to be found amongst them, which any Body might not have understood as well as they, if he had carefully studied the Writings of their *Grecian* Masters. There have been so many Thousands of *Arabick* and *Persick* MSS. brought over into *Europe*, that our learned Men can make as good, nay, perhaps, a better Judgment of the Extent of their Learning, than can be made, at this distance, of the *Greek*. There are vast Quantities of their Astronomical Observations in the *Bodleian* Library, and yet Mr. *Greaves* and Dr. *Edward Bernard*, two very able Judges, have given the World no Account of any Thing out of them, which those *Arabian* Astronomers did not, or might not have learnt from *Ptolemee's Almagest*, if we set aside their Observations which their *Grecian*

cian Masters taught them to make ;
 which, to give them their due, Dr. Ber-
 nard commends, as much more valuable
 than is commonly believed, in a Letter
 to Dr. Huntingdon, printed in the *Philo-
 sophical Transactions*, containing their
 Observations of the Latitudes of Twenty
 of the most eminent of the Fixed Stars.
 We owe, indeed, to them alone the Way
 of Counting by Ten Cyphers, ascending
 beyond Ten in a Decuple Proportion ;
 which is of unspeakable Use in *Astrono-
 mical* and *Algebraical* Calculations, and,
 indeed, in all Parts of *Arithmetick*. The
 Use of *Chymistry* in *Physick*, together
 with some of the most considerable Chy-
 mical Preparations, which have led the
 Way to most of the late Discoveries that
 have been made in that Art, and in *Na-
 tural Philosophy* by its Means, have been
 unanimously ascribed to the *Arabs* by
 those Physicians that have studied their
 Books (y). Though, in Strictness, the
 whole *Arabian* Learning, with all their
 Inventions, what, and how great soever
 they were, may be reckoned as Modern,
 according to Sir *William Temple's* Compu-
 tation. But I am willing to give it up,
 and content my self with what has been
 done by the learned Men of these two
 last Ages, since the *Greeks* brought their
 Learning

(y) Vide
 Morhofii
 Epist. ad
 Langelot-
 tum.

Learning along with them into *Italy*, upon the Taking of *Constantinople* by the *Turks*. At least, this is evident, that the old *Arabian* Learning could never be any one of those Fountains from whence the *Grecian* might have been drawn; and so can never be urged as such by those who give an Account of the History of Learning.

CHAP. XII.

Of the Learning of the Chineses.

BY this Time, I am afraid, I shall be thought as tedious as an *Irish* Tale-teller, fit for nothing but to lull my Reader asleep: But there is but one Stage more left; and though it is a great Way off, yet it may be easily reached upon Paper, and then will be as easily dispatched. For *China*, we are told, is a charming Country, and therefore most proper to be thought upon at the End of a tedious Discourse.

Sir *William Temple* knows very well, That the whole *Chinese* History depends upon the sole Authority of *Martinus*,
and

and those Missionaries who published *Confucius* lately at *Paris*. *Martinius* (z) (z) Hist. tells his Reader that he was obliged to learn Sixty Thousand independent Characters before he could read the *Chinese* Authors with Ease. This is, without all doubt, an excellent Method to propagate Learning, when Eight, or Ten of the best Years of a Man's Life must be spent in learning to read. The most considerable Specimen of *Chinese* Learning that we have, is in the Writings of *Confucius*; which if F. Couplet and his Companions had Printed under their own Names, Sir *William Temple* would have been one of the first (a) that would have called those *Rules and Instructions* *discour- 178.* sed of with great Compass of Knowledge, Excellence of Sense, Reach of Wit, illustrated with Elegance of Stile, and Aptness of Similitudes and Examples, an incoherent Rhapsody of moral Sayings, which good Sense and tolerable Experience might have furnished any Man with.

If the *Chineses* think every part of Knowledge, but their own *Confucian* Ethics, ignoble and mechanical, why are the *European* Missionaries so much respected for their Skill in Medicine and Mechanicks? So much Knowledge in Ma-
 L thematics

thematically as will but just serve an Almanack-maker, will do their Business. *F. Verbrist* says in a Letter Printed some Years since in the *Philosophical Transactions*, That the Honours which were paid him in the Emperour's Court, were in a great Measure owing to his teaching the Emperour to find the Time of the Night by the fixed Stars and an Astrolable: This shews that the *Chineses* were very meanly skilled in these things; and it is probable, that those who are ignorant of such ordinary Matters, seldom carry their Speculations to a much greater Height.

Martinius and *Trigautius*, who lived long in *China*, were able fully to inform the World of the Extent of the *Chinese* Knowledge; and the Pains which *Martinius* has taken to write the History, and to state the Geography of that mighty Empire, is a sufficient Indication of his great Willingness to advance its Reputation in *Europe*. The *Chineses* are allowed to be a sagacious and industrious People, and their Skill in many mechanical Arts shew them to be so; so that if they had ever applied themselves to Learning in good earnest, and that for near so long a Time, as their History pretends to, there is no Question but we should have heard much more of their Progress.

And

And therefore whatsoever can be said of *Chinese* Knowledge can never be of any Weight, as long as small Skill in *Physick* and *Mathematicks* shall be enough to protect the *European* Missionaries in a Court where they themselves are esteemed the greatest Scholars, and honoured accordingly.

But the *Chinese Physick* is wonderfully commended by Dr. *Vossius* and Sir *William Temple* (b): The Physicians excel in the Knowledge of the Pulse, and of all simple Medicines, and go little further: Neither need they; for in the first, they are so skillful, that they pretend not only to tell by it, how many Hours or Days a sick Man may last; but how many Years a Man in perfect seeming Health may live, in Case of no Accident or Violence; and by Simples they pretend to relieve all Diseases that Nature will allow to be cured. What this boasted Skill is, may be seen in the little Tracts of the *Chinese Physick* published by *Andrew Cleyer* (c); but because few will in all Probability have Patience to go through with them, since they are not very pleasant to read, I shall give a short Specimen of them, by which one may judge of the rest.

The most Ancient *Chinese* Discourse of *Physick*, Intituled, *Nuy Kim* (d), gives this

(b) pag.
179, 180.

(c) Specimen Medicinæ Sinicæ. Francof. 1682. Quarto.

(d) Ibid. Pag. 85, 86, 87.

this Account of the Production of our Bodies, and of the Relation of the several parts, with the Five Elements.

‘ Out of the Eastern Region arises the
 ‘ Wind, out of the Wind Wood, or Plants,
 ‘ out of Wood Acidity, from thence the
 ‘ Liver, from the Liver the Nerves, from
 ‘ them the Heart: The Liver is genera-
 ‘ ted the Third in Order, and perfected
 ‘ the Eighth: The Spirits of the Liver,
 ‘ as they relate to the Heaven (the Air)
 ‘ are Wind; as Wood in the Earth, as
 ‘ the Nerves in our Bodies, so is the Li-
 ‘ ver in the Limbs: Its Colour is Blue,
 ‘ and its Use and Action is to move the
 ‘ Nerves: The Eyes are the Windows of
 ‘ the Liver; its Taste is acid, its Passion
 ‘ or Affection is Anger: Anger hurts the
 ‘ Liver, but Sorrow and Compassion con-
 ‘ quer Anger, because Sorrow is the
 ‘ Passion of the Lungs, and the Lungs
 ‘ are Enemies to the Liver: Wind hurts
 ‘ the Nerves, but Drought, the Quality
 ‘ of the Lungs, conquers Wind: Aci-
 ‘ dity hurts the Nerves, but Acrimony,
 ‘ or that sharp Taste which is proper to
 ‘ the Lungs, conquers Acidity, or Me-
 ‘ tal conquers Wood.

‘ Out of the Southern Region arises
 ‘ Heat, out of Heat Fire, out of Fire
 ‘ Bitterness: From it the Heart is gene-
 ‘ rated

‘ rated, thence the Blood ; out of Blood
‘ comes the Spleen, or Earth out of Fire ;
‘ the Heart governs the Tongue ; that
‘ which is Heat in Heaven, Fire upon
‘ Earth, Pulsation in the Body, is the
‘ Heart in the Members : Its Colour is
‘ Red, has the Sound of Laughing ; its
‘ Vicissitudes are Joy and Sorrow ; the
‘ Tongue is its Window, its Taste Bitter-
‘ ness, its Passion Joy ; too much Joy hurts
‘ the Heart ; but Fear, the Passion of the
‘ Reins, which are Enemies to the Heart,
‘ conquers Joy : Heat hurts the Spirits,
‘ but Cold conquers Heat : Bitterness
‘ hurts the Spirits, but Saltiness of the
‘ Reins conquers Bitterness, or Water
‘ quenches Fire. The Heart is generated
‘ the Second in Order, and is perfected
‘ the Seventh.

‘ Out of the middle Region ariseth
‘ Moisture, out of that Earth ; out of
‘ Earth Sweetness ; from Sweetness com-
‘ eth the Spleen, Flesh from that, and the
‘ Lungs from Flesh : The Spleen governs
‘ the Mouth ; that which is Moisture in
‘ the Heaven, is Earth in Earth, Flesh in
‘ the Body, and the Spleen in the Mem-
‘ bers : Its Colour is Yellow ; it has the
‘ Sound of Singing ; its Window is the
‘ Mouth, its Taste is sweet, its Passion is
‘ much Thoughtfulness : Thoughtfulness

‘ hurts the Spleen, but Anger conquers
‘ Thoughtfulness : Moisture hurts Flesh,
‘ but Wind conquers Moisture : Sweet-
‘ ness hurts Flesh, but Acidity conquers
‘ Sweetness : In a Word, Wood conquers
‘ Earth, or the Liver the Spleen. The
‘ Spleen is generated the Fifth in Order,
‘ and is perfected the Tenth.

‘ Out of the Western Region arises
‘ Drought : Thence come Metals, from
‘ them comes Sharpness, out of that are
‘ the Lungs, out of the Lungs come Skin
‘ and Hair, out of Skin and Hair come
‘ the Reins ; the Lungs govern the No-
‘ strils : That which is Drought in the
‘ Heaven (or Air) is Metal in the Earth,
‘ Hair and Skin in the Body, and Lungs
‘ in the Members : Its Colour is Whitish,
‘ has the Sound of Weeping ; its Win-
‘ dows are the Nostrils, its Taste is sharp,
‘ its Passion is Sorrow : Sorrow hurts the
‘ Lungs, but Joy conquers Sorrow : Heat
‘ hurts the Skin and Hair, but the Cold
‘ of the Reins conquers Heat : Sharp-
‘ ness hurts the Skin and Hair, but Bitter-
‘ ness conquers Sharpness. The Lungs
‘ are generated the Fourth in Order and
‘ are perfected the Ninth.

‘ Out of the Northern Region arises
‘ Cold, out of Cold comes Water, thence
‘ Saltness, thence the Reins, thence the
‘ Marrow

' Marrow of the Bones, thence the Liver.
 ' The Reins govern the Ears; that which
 ' is Cold in the Air, Water in the Earth,
 ' Bones in the Body, is Reins in the
 ' Members: Its Colour is Blackish, has
 ' the Sound of Sobbing; its Windows are
 ' the Ears, its Taste is Saltness, its Passion is
 ' Fear: Fear hurts the Reins, but Thought-
 ' fulness conquers Fear: Cold hurts the
 ' Blood, but Drought conquers Cold: Salt-
 ' ness hurts the Blood, but Sweetness con-
 ' quers Saltness. The Reins are generated
 ' the First in Order, and perfected the Sixth.

The Missionary who sent this Account
 to *Cleyer* a Physician at *Batavia*, was a-
 fraid (e) that it would be thought ridi-
 culous by *Europeans*; which Fear of his
 seems to have been well grounded. Ano-
 ther who lived long in *China*, wrote also
 an Account of the *Chinese* Notions, of
 the Nature and Difference of Pulses,
 which (f) he professes that he would not
 undertake to prove by *European* Principles.
 One may judge of their Worth by the fol-
 lowing Specimen (g).

' The *Chineses* divide the Body into
 ' Three Regions: The First is from the
 ' Head to the Diaphragm: The Second
 ' from thence to the Navel, containing
 ' Stomach, Spleen, Liver and Gall, and
 ' the Third to the Feet, containing

(e) *Risum*
forte plus
movebit
Europæo,
quam plau-
sum. ibid.
pag. 87.

(f) *Haud-*
quaquam
suscipiam
principia
ista princi-
piis nostra-
tibus pro-
banda. ibid.

pag. 2.
 (g) *ibid.*
 pag. 3, 4.

‘ the Bladder, Ureters, Reins and Guts.
‘ To these Three Regions, they assign
‘ Three sorts of Pulses in each Hand.
‘ The uppermost Pulse is governed by the
‘ radical Heat, and is therefore in its own
‘ Nature overflowing and great. The
‘ lowermost is governed by the radical
‘ Moisture, which lies deeper than the
‘ rest, and is like a Root to the rest of
‘ the Branches: the middlemost lies be-
‘ tween them both, partakes equally of
‘ radical Heat and Moisture, and answers
‘ to the middle Region of the Body, as
‘ the uppermost and lowermost do to the
‘ other Two. By these Three Sorts of
‘ Pulses, they pretend to examine all Sorts
‘ of acute Diseases, and these also are ex-
‘ amined Three several Ways: Diseases
‘ in the Left-Side are shewn by the Pul-
‘ ses of the Left-Hand, and Diseases in the
‘ Right-Side by the Pulses of the Right.

It would be tedious to dwell any longer upon such Notions as these, which every Page in *Cleyer's* Book is full of: The Anatomical Figures annexed to the Tracts, which also were sent out of *China*, are so very whimsical, that a Man would almost believe the whole to be a Banter, if these Theories were not agreeable to the occasional Hints that may be found in the Travels of the Missionaries. This how-
ever,

ever does no Prejudice to their Simple Medicines, which may, perhaps, be very admirable, and which a long Experience may have taught the *Chineses* to apply with great Success; and it is possible that they may sometimes give not unhappy Guesses in ordinary Cases, by feeling their Patients Pulses: Still this is little to Physick, as an Art; and however the *Chineses* may be allowed to be excellent Empiricks, as many of the *West-Indian* Salvages are, yet it cannot be believed that they can be tolerable Philosophers; which, in an Enquiry into the Learning of any Nation, is the first Question that is to be considered.

But it is time now to leave those Countries, in some of which there seems never to have been any solid Learning originally, and in the rest but the Beginnings of it, to come to *Greece*, as it stood in the Age of *Aristotle*, *Theophrastus*, *Euclid*, and those other Great Men, who about the Time of *Alexander the Great*, and afterwards, did such great Things in almost all Parts of real Learning. If upon Enquiry it shall be found that a Comparison may be made between these Ancients and the Moderns, upon any Heads wherein Learning is principally concerned, which will not be to the Disadvantage

tage of the latter, then there needs not any Thing to be said further. Whether it can or no, is now to be enquired.

C H A P. XIII.

Of the Logick and Metaphysicks of the Ancient Greeks.

SINCE all that has been said in the Second and Third Chapters, concerning the *Ethicks, Politicks, Eloquence* and *Poesie* of the Ancient Grecians, belongs to them in their most flourishing Ages, a great Part of the Subject Matter of this Enquiry has already been dispatched. The remaining Parts of their Knowledge may be reduced to these Four Heads: *Logick, Metaphysicks, Mathematicks* and *Physiology*. *Logick* is the *Art of Reasoning*; but by it Men commonly understand the Art of Disputing, and making Syllogisms; of answering an Adversary's Objections dexterously, and making such others as cannot easily be evaded: In short, of making a plausible Defence, or starting probable Objections, for or against any Thing. As this is taught in the Schools, it is certainly owing to the Ancients:

cients: *Aristotle's Organum* is the great Text by which Modern *Logicians* have framed their Systems; and nothing, perhaps can be devised more subtile in that captious Art (*h*), than the *Sophisms* of the Ancient *Stoicks*. But as *Logick* is truly the Art of Reasoning justly, so as not only to be able to explain our own Notions, and prove our own Assertions, clearly and distinctly; but to carry our Speculations further than other Men have carried theirs, upon the same Arguments; it has not only been much cultivated by Modern Philosophers, but as far pursued as ever it was by the Ancients: For hereby have the late Enquiries been made into *Physical*, *Metaphysical* and *Mathematical* Matters, the Extent whereof is hereafter to be examined. Hereby the Ancient *Mathematicians* made their Discoveries, and when they had done they concealed their Art; for, though we have many noble Propositions of theirs, yet we have few Hints how they found them out; since the Knowledge of the fore-going Books in *Euclid's Elements* is necessary to explain the Subsequent, but is of little or no Use to help us to find out any Propositions in the subsequent Books, (which are not immediate Corollaries from what went before) in case those Books had been lost.

Whether

(h), Vide
A. Gellii
Noct. Ar-
tic. lib. I.
cap. 2.

Whether the Moderns have been deficient in this noble Part of *Logick*, may be seen by those who will compare *Des Cartes's Discourse of Method*, Mr. *Lock's Essay of Humane Understanding*, and *Tschirnhaus's Medicina Mentis*, with what we have of the Ancients concerning the *Art of Thinking*: Where, though it may be pretended that their Thoughts and Discoveries are not entirely new in themselves, yet to us, at least, they are so, since they are not immediately owing to ancient Assistances, but to their own Strength of Thought, and Force of Genius. And since this Art is, indeed, the Foundation of all Knowledge, I ought to take notice, that my Lord *Bacon* and *Des Cartes* were the two Great Men, who both found Fault with the *Logick* of the Schools, as insufficient of it self for the great Design of *Logick*, which is the Advancement of real Learning; and got Authority enough to persuade the World, in a very great Degree, that other Methods must be taken, besides making Syllogisms; and ranking the Sorts of Things under Predicaments and Predicables, by those who would go much farther than their Predecessors went before them. The true Use of the common *Logick*, being rather to explain what we know already, and to detect the Fallacies

lacies of our Adversaries, than to find that out, of which we before were ignorant. So that the Moderns have enlarged its Bottom ; and by adding that *Desideratum* which the Ancients either did not perfectly know, or, which is worse, did invidiously conceal, namely, *the Method of discovering unknown Truths*, as Monsieur *Tschirnhaus* calls it, have, if not made it perfect, yet put it into such a Posture, as that future Industry may very happily compleat it.

Metaphysicks is properly that Science which teaches us those Things that are out of the Sphere of Matter and Motion, and is conversant about God, and Spirits, and Incorporeal Substances. Of these Things *Plato* and his Disciples wrote a great deal : They plainly saw, that something beyond Matter was requisite to create and preserve the August Frame of the World. If we abstract from Revelation, the *Cartesians* discourse more intelligibly concerning them, than any of the Ancients. So that though very many of their particular Notions, as also of F. *Mallebranche's*, *M. Poyret's*, and other Modern *Metaphysicians*, are justly liable to Exception, yet the main Foundations upon which they reason, are, for the most part, real ; and so, by Consequence, the Super-

Superstructures are not entirely fantastical: And therefore they afford a vast Number of Hints to those who love to apply their Thoughts that Way, which are useful to enlarge Men's Understandings, and to guide their Manners. This, which is strictly true of the Modern *Metaphysicks*, is as much as can be said of the Ancient: And because a Comparison cannot be made without reading their several Writings, the surest Way to try the Truth of this Proposition will be to read *Plato* and his Commentators; and along with them, *Des Cartes's Meditations*, *Velthuyssius de Initiis primæ Philosophiæ*, *Mallebranche's Recherche de la Verité*, *Poyret's Cogitationes de Deo*, and *Mr. Lock's Essay of Humane Understanding*, already mentioned. This may be done without undervaluing what the Ancients wrote upon these noble Subjects: And the Question is not, Whether they were great Men? But, Whether the Moderns have said any Thing upon these Matters, without Copying out of other Men's Writings? Which, unless we will do them Wrong, we are bound to say they have.

CHAP. XIV.

*Of Ancient and Modern Geometry
and Arithmetick.*

IN the Method which I set to my self in these *Reflections*, I chose to begin with an Enquiry into those Sciences, whose Extent is more liable to be contested; and so onwards, to those which may more easily be determined. Monsieur *Perrault*, who has not finished his *Parallel*, that I know of, took it for granted, that if the Prize were granted to the Moderns in *Eloquence*, in *Poesie*, in *Architecture*, in *Painting*, and in *Statuary*, the Cause would be given up in every Thing else; and he, as the declared Advocate for the Moderns, might go on triumphantly with all the rest. Wherein, possibly, he was not, in the main, much mistaken. How he manages the remaining Part of his *Parallel*, I know not. I intend to begin with *Abstracted Mathematicks*; both because all its Propositions are of Eternal Truth, and besides, are the Genuine Foundations upon which all real *Physiology* must be built.

The

The Method which I shall follow is this: (1.) I shall enquire into the State of Ancient and Modern *Mathematicks*, without any particular Application of the Properties of the several Lines and Numbers, Surfaces and Solids, to Physical Things. (2.) I shall enquire what new Instruments have been invented, or old ones improved, by which the Knowledge of Nature of any sort has been, or may be, further enlarged. (3.) I shall enquire whether any Improvements have been actually made of *Natural History*, and of any *Physico-Mathematical* or *Physical* Sciences, such as *Astronomy*, *Musick*, *Opticks*, *Medicks*, and the like. (4.) From all this, I shall endeavour to pass a Judgment upon the Ancient and Modern Ways of *Philosophizing* concerning Nature in general, and its principal *Phænomena*, or *Appearances*.

I begin with *Geometry* and *Arithmetick*, because they are general Instruments whereby we come to the Knowledge of many of the abstrusest Things in Nature; since, as *Plato* said of old, *God always Geometrizes in all his Works*. That this Comparison might be the more exact, I desired my learned and worthy Friend, *Mr. John Craige*, to give me his Thoughts upon this Matter: His own learned Writings

tings upon the most difficult Parts of Geometry, for such are the *Quadratures of Curve Lines*, will be sufficient Vouchers for his Skill in these Things. I shall set down what he says, in his own Words.

‘ If we take a short View of the Geometry of the Ancients, it appears, that they considered no *Lines*, except *Streight Lines*, the *Circle*, and the *Conick Sections*: As for the *Spiral*, the *Quadratrix*, the *Conchoid*, the *Cissoid*, and a few others, they made little or no Account of them. It is true, they have given us many excellent and useful Theorems concerning the Properties of these others; but far short of what has been discovered since. Thus the *Quadrature of the Circle*, which did so much exercise and perplex the Thoughts of the Ancients; How imperfect is that of *Archimedes*, in comparison of that exhibited by *Van Ceulen*? And every Body knows how this is exceeded by the later Performances of Mr. *Newton*, and Monsieur *Leibnitz*. *Archimedes*, with a great deal of Labour, has given us the exact *Quadrature of the Parabola*; but the *Rectification of the Parabolick Line*, depending on the *Quadrature of the Hyperbola*, is the Invention of this last Age. The rare Properties of the *Conick Sections*,

' *Etions*, in the *Reflexion* and *Refraction*
 ' of *Light*, are the undoubted Discoveries
 ' of these later Times. It were easie to
 ' give more Instances of this Nature, but
 ' these are sufficient to shew how far the
 ' Modern Mathematicians have out-done
 ' the Ancients, in discovering the noblest
 ' and usefulest Theorems, even of those
 ' few Figures which they chiefly consi-
 ' dered.

' But all this is nothing, in Compari-
 ' son of that boundless Extent which the
 ' Modern Mathematicians have carried
 ' Geometry on to: Which consists in their
 ' receiving into it all the *Curve Lines* in
 ' Nature, together with the *Area's* and
 ' *Solids* that result from them; by distin-
 ' guishing them into certain *Kinds*, and
 ' *Orders*; by giving general Methods of
 ' describing them, of determining their
 ' *Tangents*, their *Lengths*, their *Area's*,
 ' and the *Solids* made by the Rotation of
 ' them about their Axes. Add to all this,
 ' the general Methods that have been in-
 ' vented of late for finding the Properties
 ' of a great Number of these *Curves*, for
 ' the Advancement of *Opticks*, *Mecha-*
 ' *nicks*, and other Parts of *Philosophy*:
 ' And let any Man of Sense give the Pre-
 ' ference to the Ancient Geometry if he
 ' can.

' That

‘ That the Ancients had general Methods of Constructing all plain Problems by a streight Line and a Circle, as also all Solid Problems by the help of a Conick Section, is most certain. But it is as certain that here they stopped, and could go no further, because they would not receive any Order of Curves beyond the Conick Sections, upon some nice Scrupulosity in multiplying the Number of the *Postulata*, requisite to the describing of them. Whereas the Modern Geometers, particularly the renowned *Des Cartes*, have given general Rules for Constructing all Problems of the 5th. or 6th. Degree. Which Method, if rightly understood, is applicable to all Problems of any Superior Order.

‘ How deficient the Geometry of the Ancients was in that Part which related to the *Loca Geometrica*, is manifest from the Account that *Pappus* gives us of that Question, about which *Euclid* and *Apolonius* made so many ineffectual Attempts: The Solution whereof we owe entirely to Mr. *Isaac Newton* (i). For it is evident that *Des Cartes* mistook the true Intent of the Ancients in this Matter. So that the *Loca Solida* is now one of the perfectest Parts of Geometry that we have; which before

(i) Philos.
P. 74, 75.

‘ was one of the most confused, and defective.

(k) History of Algebra, pag. 285.

‘ From comparing the Ancient and Modern Geometry, I proceed to the Comparison of those Arts, to which we owe the Improvements both of the one, and the other. These are chiefly Two, viz. *Algebra*, and the *Method of Indivisibles*. As to the latter of these, I shall not stand to enquire whether *Cavallerius* was the first Inventor, or only the Restorer of it. I know (k) Dr. *Wallis* is of Opinion that it is nothing but the Ancients *Method of Exhaustions*, a little disguised. It is enough for your Purpose, that by the help of *Cavallerius*’s Method, Geometry has been more promoted in this last Age, than it was in all the Ages before. It not only affords us neat and short Demonstrations, but shews us how to find out the abstrusest Theorems in Geometry. So that there has hardly been any considerable Improvement of late, which does not owe its Rise to it; as any Man may see, that considers the Works of *Cartes*, *Fermat*, *Van Heuruet*, *Huygens*, *Neil*, *Wallis*, *Barrow*, *Mercator*, *Leibnitz*, and *Newton*. *Archimedes*’s Propositions of the Properties of a Sphere and a Cylinder, are some of the easiest Examples of this Method. How vastly
‘ more

‘ more curious, and more useful Theo-
 ‘ rem’s have been since added to Geome-
 ‘ try, is known to every one that is con-
 ‘ versant in the afore-mentioned Authors;
 ‘ especially Mr. *Newton*, *Leibnitz* and
 ‘ *Huygens*: To instance particulars, were
 ‘ to transcribe their whole Books and
 ‘ Treatises.

‘ Let us, in the next Place, compare
 ‘ the *Ancient and Modern Algebra*. That
 ‘ the Ancients had some kind of *Algèbra*,
 ‘ like unto ours, is the Opinion of several
 ‘ learned Writers of late: And it is evi-
 ‘ dent from the Seven remaining Books of
 ‘ *Diophantus*, that it was brought to a
 ‘ considerable Length in his Time. But
 ‘ how infinitely short this was of that *Al-*
 ‘ *gebra* which we now have, since *Vieta*’s
 ‘ Time, will appear to any that considers
 ‘ the different Process of both. For, tho’
 ‘ *Diophantus* has given us the Solution of
 ‘ a great many hard and knotty Arithme-
 ‘ tical Problems, yet the last Step of his
 ‘ Resolution serves only for one particular
 ‘ Example of each Problem: So that for
 ‘ every new Example of the same Que-
 ‘ stion, there must be a new Process made
 ‘ of the whole *Analysis*. Whereas by our
 ‘ Modern *Algebra*, the *Analysis* of any
 ‘ one Case gives a general Canon for all
 ‘ the infinite Cases of each Problem;

‘ whereby we discover many curious
‘ Theorems about the Properties of Num-
‘ bers, not to be attained by *Diophantus*’s
‘ Method; this being the peculiar Ad-
‘ vantage of *Specious Algebra*, first intro-
‘ duced by *Vieta*, and wonderfully pro-
‘ moted by several worthy Mathemati-
‘ cians since. Beside this intolerable Im-
‘ perfection of the Ancient *Algebra*, used
‘ by *Diophantus*, which required as many
‘ different Operations as the Problem had
‘ different Examples, that is, infinite; all
‘ which are included in one general Solu-
‘ tion by the Modern *Algebra*; there is
‘ this great Defect in it, that in *Undeter-*
‘ *mined Questions*, which are capable of
‘ innumerable Solutions, *Diophantus*’s *Al-*
‘ *gebra* can seldom find any more than
‘ one; whereas, by the Modern *Algebra*,
‘ we can find innumerable, sometimes all
‘ in one Analysis; though in many
‘ Problems we are obliged to re-iterate
‘ the Operation for every new Answer.
‘ This is sufficient to let you see, that
‘ (even in the Literal Sense) our *Algebra*
‘ does infinitely exceed that of the An-
‘ cients. Nor does the Excellency of our
‘ *Algebra* appear less in the great Im-
‘ provements of Geometry. The redu-
‘ cing all Problems to Analytical Terms,
‘ has given Rise to those many excellent
‘ Methods,

‘ Methods, whereby we have advanced
‘ Geometry infinitely beyond the Limits
‘ assigned to it by the Ancients. To this
‘ we owe, (1.) The Expressing all Curves
‘ by Equations, whereby we have a View
‘ of their Order, proceeding gradually on
‘ *in infinitum*. (2.) The Method of
‘ Constructing all Problems of any Af-
‘ signable Dimension; whereas the An-
‘ cients never exceeded the Third. Nay,
‘ from the Account which *Pappus* gives us
‘ of the afore-mentioned Question, it is
‘ evident, that the Ancients could go no
‘ further than Cubick Equations: For he
‘ says expressly, they knew not what to
‘ make of the continual Multiplication of
‘ any Number of Lines more than Three;
‘ they had no Notion of it. (3.) The
‘ Method of Measuring the *Area’s* of ma-
‘ ny Infinities of Curvilinear Spaces;
‘ whereas *Archimedes* laboured with great
‘ Difficulty, and wrote a particular Trea-
‘ tise of the Quadrature of only one (1), (1) *The Pa-*
‘ which is the simplest and easiest in Na- *rabola.*
‘ ture. (4.) The Method of Determi-
‘ ning the Tangents of all Geometrick
‘ Curve Lines; whereas the Ancients
‘ went no further than in determining
‘ the Tangents of the Circle and Conick
‘ Sections. (5.) The Method of Deter-
‘ mining the Lengths of an infinite Num-
‘ ber

‘ ber of Curves ; whereas the Ancients
 ‘ could never measure the Length of one.
 ‘ If I should descend to Particulars, the
 ‘ Time would fail me. As our *Algebra*,
 ‘ so also our *Common Arithmetick* is prodi-
 ‘ giously more perfect than theirs ; of
 ‘ which, *Decimal Arithmetick* and *Loga-*
 ‘ *rithms* are so evident a Proof, that I
 ‘ need say no more about it.

‘ I would not be thought, however,
 ‘ to have any Design to sully the Reputa-
 ‘ tion of those Great Men, *Conon*, *Ar-*
 ‘ *chimedes*, *Euclid*, *Apollonius*, &c. who,
 ‘ if they had lived to enjoy our Assistance,
 ‘ as we now do some of theirs, would,
 ‘ questionless, have been the greatest Or-
 ‘ naments of this Age, as they were de-
 ‘ servedly the greatest Glory of their own.
 Thus far Mr. *Craig*.

Those that have the Curiosity to see
 some of these Things proved at large,
 which Mr. *Craig* has contracted into one
 View, may be amply satisfied in Dr. *Wal-*
lis's History of Algebra, joyned with *Ger-*
hard Vossius's Discourses De Scientiis Ma-
thematicis.

It must not here be forgotten, that Ab-
 stracted Mathematical Sciences were ex-
 ceedingly valued by the ancientest Philo-
 sophers : None that I know of expressing
 a Contempt of them but *Epicurus*, tho’
 all

all did not study them alike. *Plato* is said to have written over the Door of his Academy, *Let no Man enter here, who does not understand Geometry.* None of all the learned Ancients has been more extolled by other learned Ancients, than *Archimedes*. So that if in these Things the Moderns have made so great a Progress, this affords a convincing Argument, that it was not Want of Genius which obliged them to stop at, or to come behind the Ancients in any Thing else.

CHAP. XV.

Of several Instruments invented by the Moderns, which have helped to advance Learning.

HAVING now enquired into the State of Mathematicks, as they relate to Lines and Numbers in general, I am next to go to those Sciences which consider them as they are applied to Material Things. But these being of several Sorts, and of a vast Extent, taking in no less than the whole Material World, it ought

ought to be observed, that they cannot be brought to any great Perfection, without Numbers of Tools, or Arts, which may be of the same Use as Tools, to make the Way plain to several Things, which otherwise, without their Help, would be inaccessible.

Of these Tools, or Instruments, some were anciently invented, and those Inventions were diligently pursued: Others are wholly new. According to their Uses, they may be ranged under these two General Heads: (1.) Those which are useful to all Parts of Learning, though perhaps not to all alike. (2.) Those which are particularly subservient to a Natural Philosopher, and a Mathematician. Under the first Head one may place *Printing*, and *Engraving*. Under the Latter come *Telescopes*, *Microscopes*, the *Thermometer*, the *Baroscope*, the *Air-Pump*, *Pendulum-Clocks*, *Chymistry*, and *Anatomy*. All these, but the two last, were absolutely unknown to former Ages. *Chymistry* was known to the *Greeks*, and from them carried to the *Arabs*. *Anatomy* is, at least, as old as *Democritus* and *Hippocrates*; and among the *exact Egyptians*, something older.

The Use of *Printing* has been so vast, that every thing else wherein the Moderns have

have pretended to excel the Ancients, is almost entirely owing to it : And withal, its general Uses are so obvious, that it would be Time lost to enlarge upon them; but it must be taken Notice of, because Sir *William Temple* has questioned *(m)* *(m)* Pag. 6. *whether Printing has multiplied Books, or only the Copies of them*, from whence he concludes, that we are not to suppose that the Ancients had not equal Advantages by the Writings of those that were ancient to them, as we have by the Writings of those that are ancient to us. But he may easily solve his own Doubt, if he does but reflect upon the Benefit to Learning which arises from the *multiplying Copies* of good Books : For though it should be allowed, that there were anciently as many Books as there are now, which is scarce credible, yet still the Moderns have hereby a vast Advantage, because, (1.) Books are hereby much cheaper, and so come into more Hands. (2.) They are much more easily read ; and so there is no Time lost in poring upon bad Hands, which wastes Time, wearies the Reader, and spoils Mens Eyes. (3.) They can be printed with Indexes, and other necessary Divisions, which, though they may be made in MSS. yet they will make them so voluminous and cumbersome,

some, that not one in Forty who now mind Books, because they love Reading, would then apply themselves to it.

(4.) The Notice of new and excellent Books is more easily dispersed.

(5.) The Text is hereby better preserved entire, and is not so liable to be corrupted by the Ignorance or Malice of Transcribers; this is of great Moment in Mathematicks, where the Alteration of a Letter, or a Cypher, may make a Demonstration unintelligible. But to say more upon this Subject would be to abuse Mens Patience, since these things, if not self-evident, yet need no Proof.

Engraving upon Wood, or Copper, is of great Use in all those Parts of Knowledge where the Imagination must be assisted by sensible Images. For want of this noble Art, the *Ancient Books of Natural History and Mechanical Arts*, are almost every where obscure; in many Places unintelligible. *Mathematical Diagrams*, which need only a Ruler and a pair of Compasses, have been better preserved, and could with more Ease be drawn: But in *Anatomy*, in *Mechanicks*, in *Geography*, in all Parts of *Natural History*, *Engraving* is so necessary, and has been so very advantageous, that without it, many of those Arts and Sciences would to this

Hour

Hour have received very little Increase. For when the Images, the Proportions, and the Distances of those things wherein a Writer intends to instruct his Reader, are fully and minutely engraven in Prints, it not only saves Abundance of Words, by which all Descriptions must of Necessity be obscured, but it makes those Words which are used, full and clear; so that a skillful Reader is thereby enabled to pass an exact Judgment, and can understand his Authors without a Master, which otherwise it would be impossible to do; so as to be able to discern all, even the minutest Mistakes and Oversights in their Writings, which puts an end to Disputes, and encreases Knowledge.

These are general Instruments, and more or less serviceable to all sorts of learned Men in their several Professions and Sciences: Those that follow are more particular: I shall begin with those that assist the Eye, either to discern Objects that are too far off, or too small.

The *Imperfections* of *Distance* are remedied in a great Measure by *Telescopes*; whose chief Use, that comes under our Consideration, is to discern the Stars, and other celestial Bodies.

To find out the first Inventor of these sorts of Glasses, it will be necessary to learn

learn who first found out the Properties of Convex and Concave Glasses in the Refraction of Light. Dr. *Plot* has collected a great deal concerning F. *Bacon*, in his *Natural History of Oxfordshire*; which seems to put it out of doubt that he knew that great Objects might appear little, and small Objects appear great; that distant Objects would seem near, and near Objects seem afar off, by different Applications of Convex and Concave Glasses; upon the Credit of which Authorities, Mr. *Molineux* (n) attributes the Invention of Spectacles to this learned Friar, the Time to which their earliest Use may be traced, agreeing very well with the Time in which he lived; but how far F. *Bacon* went, we know not: So that we must go into *Holland* for the first Inventors of these excellent Instruments, and there they were first found out by one *Zacharias Joannides* (o), a Spectacle-maker (p) of *Middleburgh* in *Zeland*; in 1590 (q) he presented a Telescope of Two Glasses to Prince *Maurice*, and another to Arch-Duke *Albert*, the former of whom apprehending that they might be of great Use in War, desired him to conceal his Secret. For this Reason, his Name was so little known, that neither *Des Cartes* (r) nor *Gerhard Vossius* (s)

(n) Diop-
tric. Pag.
256, 257,
258.

(o) Borel-
lus de vero
Inventore
Telescopii,
pag. 30.

(p) Ibid.
Pag. 35.

(q) Ibid.
Pag. 30.

(r) Diop-
tric.

sus (s)

sius (s) had ever heard any thing of him, when they attributed the Invention of Telescopes to *Jacobus Metius* of *Alkmaer*. p. 70.

However it taking Air, *Galileo Galilei* took the Hint, and made several Telescopes, by which making Observations upon heavenly Bodies, he got himself immortal Honour. Thereby (t) he discovered Four Planets moving constantly round *Jupiter*, from thence usually called his *Satellites*, which afterwards were observed to have a constant, regular, and periodical Motion. This Motion is now so exactly known, that Mr. *Flamsteed*, who is one of the most accurate Observers that ever was, has been able to calculate Tables of the Eclipses of the several *Satellites*, according to which, Astronomers in different quarters of the World, having Notice of the precise Time when to look for them, have found them to answer to his Predictions, and published their Observations accordingly. This is an effectual Answer to all that Rhapsody which *Stubbe* (u) has collected in his Brutal Answer to Mr. *Glanville's Plus Ultra*, about the Uncertainty of all Observations made by Telescopes; since it is impossible to calculate the Duration of any Motion justly by fallacious and uncertain Methods. By the Eclipses of *Jupiter's*

(f) De scientiis Mathematicis.

(t) Vide Galilæi Nuntium sidereum primò nè fallor, impressum, A. D. MDCVIII.

(u) Plus Ultra reduced to a Non-plus. Pag. 28, 36.

(w) *Vide*
Philosoph.
Transact.
no. 177.

(x) Sele-
nograph.
(y) Alma-
gest.

Jupiter's Satellites, Longitudes would soon be exactly determined if Tubes of any Length could be managed at Sea. (w) But *Jupiter* is not the only Planet about which things anciently unknown have been revealed by this noble Instrument. The Moon has been discovered to be an Earth endued with a libratory Motion, of an uneven Surface, which has something analogous to Hills and Dales, Plains and Seas; and a new Geography (if one may use that Word without a Blunder) with accurate Maps has been published by the great *Hevelius* (x), and improved by *Ricciolus* (y), by which Eclipses may be observed much more nicely than could be done formerly: The Sun has been found to have Spots at some times; the Planets to move round their Axes; *Saturn* to have a Luminous Ring round about his Body, which in some Positions appears like two Handles, as they are commonly called, or large Prominencies on opposite Parts of his Limbs, carried along with him, beside Five Planets moving periodically about him, as those others do about *Jupiter*: The milky Way to be a Cluster of numberless Stars; the other parts of the Heaven to be filled with an incredible Number of fixed Stars, of which, if *Hevelius's* Globes are ever pub-

published, the World may hope to see a Catalogue. These are some of the remarkable Discoveries that have been made by *Telescopes*: And as new Things have been revealed, so old ones have been much more nicely observed, than formerly it was possible to observe them.

But I need not enlarge upon particular Proofs of that, which every Astronomical Book, printed within these Fifty Years, is full of. If I should, it would be said, perhaps, that I had only copied from the *French Author of the Plurality of Worlds*, so often mentioned already.

As some Things are too far off, so others are too small to be seen without help. This last Defect is admirably supplied by *Microscopes*, invented by the same *Zacharias Joannides (z)*; which, besides Miscellaneous and Occasional Observations, have been applied to *Anatomy*, by *Malpighius*, *Leenwenhoeck*, *Grew*, *Havers*, and several others. The first very considerable Essay to shew what might be discovered in Nature, by the help of *Microscopes*, was made by *Dr. Hook*, in his *Micrography*; wherein he made various Observations, upon very different Sorts of Bodies. One may easily imagine what Light they must needs give unto the nicer Mechanism of most Kinds of Bodies,

(z) Borellus, ubi supra, p. 35.

N

when

when Monsieur *Leeuwenhoeck* has plainly proved, that he could, with his Glasses, discern Bodies several Millions of Times less than a Grain of Sand. This may be relied upon, because Dr. *Hook*, who examined what *Leeuwenhoeck* says of the little Animals which he discerned in Water, of which he tells the most wonderful Things, does, in his *Microscopium*, attest the Truth of *Leeuwenhoeck*'s Observations.

Besides these which are of more universal Use, several other *Instruments* have been invented, which have been very serviceable to find out the Properties of Natural Bodies; and by which several Things of very great Moment, utterly unknown to the Ancients, have been detected. As,

(a) Borel-
lus de motu
Animalium
Part. II.
Prop.
clxxv.

I. The *Thermometer*, invented (a) by *Sanctorius*, an eminent Physician of *Padua*. Its immediate Use is, to determine the several Degrees of Heat and Cold; of which our Senses can give us but uncertain Notices; because they do not so much inform us of the State of the Air in it self, as what its Operations are at that Time upon our Bodies. But *Sanctorius* used only open Vessels, which are of small Use, since Liquors may rise or fall in the Tubes, as well from the Increase or Dimi-

Diminution of the Weight of the Air, as of Heat and Cold. That Defect was remedied by Mr. Boyle (b), who sealed up the Liquors in the Tubes, Hermetically, that so nothing but only Heat and Cold might have any Operation upon them. The Uses to which they have been applied, may be seen at large in Mr. Boyle's *History of Cold*, and *the Experiments of the Academy del Cimento*.

(b) See his
Thermo-
metrical
Thoughts,
prefixed to
his History
of Cold.

2. The Baroscope, or Torricellian Experiment; so called from its Inventor, Evangelista Torricelli, a Florentine Mathematician; who, about the Year 1643. found that Quick-Silver would stand erect in a Tube, above 28 Inches from the Surface of other Quick-Silver into which the Tube was immersed, if it was before well purged of Air. This noble Experiment soon convinced the World, that the Air is an actually heavy Body, and gravitates upon every Thing here below. This Gravitation being found unequal at several Times, Mr. Boyle applied this Instrument to Mechanical Uses (c), and shewed how it might teach us to know the Differences and Changes of Weather; when dry, and when wet; since, by a vast Number of Observations, he had learnt, that in dry Weather the Air drove up the Mercury, and in wet

(c) Philos.
Transact.
Num. 9,
10, 11-55.

Weather let it fall again ; though never lower than 28 Inches, and scarce ever higher than 32.

3. These Observations, with other Collateral Experiments, induced him to believe that the Air was, in Truth, a Springy Body, which expanded or contracted it self in a Reciprocal Proportion, to the Increase or Lessening of the Compression of the Ambient Bodies. For which he invented an Instrument to draw the Air out of Vessels that were filled with it, by Suction. The first Essays of that kind seem to have been made some Years before his appeared, by *Otto Guerick* of *Magdebourg* ; but as he applied them chiefly to the Gravitation of the Air, without taking any notice of its Spring ; so they were very imperfect, when compared to *Mr. Boyle's*. By this *Air-Pump*, as it is usually called, he discovered Abundance of Properties in the Air, before never suspected to be in it. What they are, either considered singly, or in their Operations upon all sorts of Bodies, may be seen at large in his *Physico-Mechanical Experiments concerning the Weight and Spring of the Air* ; and in several of his other Discourses upon the same Argument ; some of which are printed by themselves, and others in the
Phi-

Philosophical Transactions (d).

How far they may be relied upon appears from this; That though *Hobbes* and *Linus* have taken a great deal of Pains to destroy Mr. *Boyle's* Theory,

yet they have had few or no Abettors: Whereas the Doctrine of the *Weight and Spring of the Air*, first made thorowly intelligible by Mr. *Boyle*, has universally gained Assent from Philosophers of all Nations who have, for these last Thirty Years, busied themselves about Natural Enquiries.

4. The Invention of *Pendulum-Clocks* ought here to be remembred, since from them it appears, that the Diurnal Motion of the Earth is not so exactly Periodical, as that a true Equation of Time can thereby be obtained; but by this Instrument, the Measure of the Variation being once adjusted, the true Time of the Earth's Diurnal Motion can, at all Seasons of the Year, be more exactly known. The Use of it in making of Astronomical Observations is also very obvious; for they could not anciently be so minute as they are at present, for want of such nice Sub-Divisions of an equable Motion as it affords. The Invention of this noble Instrument is attributed, by the Publisher of

(d) Num. 62, 63, 122.
Vide Catalogue of Mr. Boyle's Works, at the End of the First Part of the Medicinal Experiments, Printed 1692. in Twelves.

(e) Experiments of the Academy del Cimento, p. 12. Edit. Eng.

the Experiments of the Academy *del Cimento*, to *Galileo Galilei*, who found out so many excellent Theorems of the Nature and Proportions of the Motions of Projected and Vibrating Bodies. He says that *Galileo* first applied the *Pendulum* to *Clock-work*; and that his Son *Vincenzio* put it in practice in the Year 1649 (e). It was little taken notice of, however, in these Parts, till Monsieur *Huygens* revived or invented it a-new; to whom, for that Reason, the Glory of finding out this useful Instrument is commonly attributed. Upon this Occasion I ought not to omit that great Improvement of Watches, by adding a Second Spring to balance the First; (as the *Pendulum* in a Clock does the Weights) which also is attributed to Monsieur *Huygens*, though he and Dr. *Hook* have both contended for the Honour of this useful Invention. It appears by the *Philosophical Transactions*, and by Dr. *Hook's Lectures*, that he had a right Notion of this Matter, and that he had made several Essays to reduce it to Practice, some Years before any of Monsieur *Huygens's* Watches were produced; but that Monsieur *Huygens* first made *Pendulum-Watches* (so they are commonly called) that proved thoroughly serviceable. These will not be disputed to be

be Modern Inventions, since the whole Business of Clocks and Watches was unknown to all, even the *Arabian*, Antiquity (f): Their Astronomers measured their Time by Hour-Glasses of Water, or Vibrating Strings of several Lengths; which would, indeed, serve them, in most Cases, to measure Time nicely by, whilst they were observing; though they were of no Use upon other Occasions; and even then were liable to great Hazards.

(f) See Dr. Edw. Bernard's Letter to Dr. Huntingdon, about the Latitude of Twenty Fixed Stars, from Arabian Observat. Phil. Trans.

CHAP. XVI.

Of Ancient and Modern Chymistry.

Chymistry, or the Art of Dividing Bodies by Fire, comes next to be considered. So great Things have thereby been discovered in Nature, that were unknown without it, that it may justly be esteemed as one of the chiefest Instruments whereby Real Knowledge has been advanced. It has been cultivated by three Sorts of Men, for very different Reasons; by *Refiners*, *Alchemists*, and *Chymists*, properly so called. The *Refiner's*

(g) Gen.
4. 22.

(h) Psal.
12. 6.

Art, which is older than the Flood, is in *Holy Scripture* ascribed to *Tubal-Cain*, as its first Inventor (g). The early Use of Gold and Silver, as Instruments of Exchange in Trade, in the Eastern Parts, shews, that Men very anciently knew how to separate Metals from their Dross, to a great Degree. And as frequent Purifications are necessary for that Work, so we find that the Necessity of them was long ago commonly known, since *David* compared a Righteous Man to Silver Seven Times purified in the Fire (h). Yet that their Art was comparatively rude, is certain, because they did not know how to separate Gold from Silver; besides a very great many other Secrets relating to that Art, which could not be known before the Way of Making *Aqua Fortes*: And their particular Qualities in corroding several sorts of Metals were discovered, and applied to these Purposes.

I have spoken already of *Alchemy*, or the Art of Making Gold; and so I shall pass on to the *Chymist's Art*, which consists in making such Analyses of Bodies by Fire, or other Agents, Chymically prepared, as may reduce them into more simple Substances, than those out of which they were before compounded. The Discoveries which have been hereby made

made are so very much later than those Ages which Sir *William Temple* contends for, that those who thought they had a great deal to say for the other Parts of *Chymistry*, do here give up the Controversie. *Borrichius* himself owns, that *Hippocrates*, *Aristotle* and *Galen* knew so little of *Chymistry*, that they could not so much as make *Rose-water*. Now, though he says this with a Design to disparage their Skill in *Physick*, when compared with the *Egyptian*, yet therein he destroys his own Hypothesis; because, in several Places of his *Vindication of the Hermetical and Chymical Philosophy and Medicine*, against *Conringius's* Book *De Medicina Hermetica*, he takes Pains to prove, that the Knowledge of these very Men was originally owing to the *Egyptians*. But the Thing speaks it self: The inward Use of Antimonial, Vitriolick, and Mercurial Preparations in *Physick*, was very little known before the Time of *Basilius Valentinus*, and *Paracelsus*: What was ancienter, was taken from the *Arabs*, who are Moderns against Sir *William Temple*.

(i) They may be looked upon as the first Inventors of Chymical Medicine: (ii) *Borrichius de Ortu & Prog. Chem.*

(i) They first extracted Vinous Spirits from Fermented Liquors: Not to mention *Morhofius ad Langelottum.*

tion Abundance of other Preparations, which *Arnoldus de Villa Nova*, *Raymund Lully*, his Scholar, and *F. Bacon* learned from them. I will not deny but some Chymical Experiments were very anciently known. *Solomon* (k) hints at the Disagreement of *Vinegar* and *Nitre*; which, though not intelligible of common *Nitre*, yet, as *Mr. Boyle* (l) found by his own Experience, it is certainly true of *Egyptian Nitre*; which, as being a natural *Alkali*, will cause an Ebullition, when joined with any Acid Salt. The Property of *Mercury* to mix, or, as the *Chymists* speak, to *Amalgamate* with Gold, was known in *Vitruvius's* Time: Though by that one may perceive, that very few of its other Properties were then known; since *Pliny*, who mentions that Quality of *Mercury*, that it will *Amalgamate* with Gold, speaks of it as a singular Thing, in these Words,

(m) Every Thing swims upon Quick-Silver but Gold; that only it draws to it self.

Whereas now every Body knows that *Mercury* will *Amalgamate* with all Metals but Copper and Iron. And if the Ancients Skill in Minerals may be judged of by *Pliny's* Accounts, they

(k) Prov.
25. 20.

(l) Boyle's
Produci-
bleness of
Chymical
Principles.
P. 30, 31.

(m) *Omnia ei innatant
præter aurum; id unum
ad se trahit. N. H. lib.
xxxiii. cap. 6.*

they (n) believed that Lead was heavier, and more ductile than Gold.

(n) Nec
pondere aut
facilitate

materia prælatum est cæteris metallis, cum cedat per utrumque plumbo.
N. H. lib. xxxiii. cap. 3.

Some Passages likewise are produced by *Borrichius*, to prove that the Ancients understood something of Calcinations, and the Use of Lixivate Salts: But these Things are very few, very imperfect, and occasional. Chymistry was not esteemed as a distinct Art; or the Analyses thereby produced, worthy a Philosopher's Notice; though the Industry of later Ages have found them to be so regular and remarkable, that many Persons have thought that the Constituent Principles of Mixed Bodies are no other Way so certainly to be found out. Hence have the *Hypotheses* of the *Paracelsians* taken their Beginning; who held, that *Salt, Sulphur* and *Mercury* were the active Principles of Composition of all Mixed Bodies. Hence several others have been led to believe, that the Primary Constituents of very many Bodies were *Acid* and *Alkalizate Salts*. Which Hypotheses, though liable to many Exceptions, as Mr. *Boyle* (o) has fully proved, are founded upon such a Variety of surprising Experiments, that those who first started

(o) Scepti-
cal Chy-
mist, and
Product.
of Chymi-
cal Prin-
ciples.

started them were not so unadvised, as one that is wholly unacquainted with the Laboratories of the *Chymists* might, at first View, suspect. For it is certain, that five distinct and tolerably uniform Substances may be drawn from most Vegetable and Animal Substances, by Fire; namely, *Phlegm*, *Fixed Salt*, *Oil*, *Earth*, and *Spirit*, or Volatile Salt dissolved in *Phlegm*. So that here is a new Field of Knowledge, of which the Ancients had no sort of Notion.

(p) See
Mr Boyle's
Usefulness
of Expe-
rimental
Philoso-
phy.

The great and successful Change hereby made (p) in the *Pharmaceutical* Part of Physick, shews that these Philosophers by Fire have spent their Time to very good purpose. Those Physicians who reason upon *Galenical* Principles acknowledge, that in very many Cases, the *Tinctures*, *Extracts*, *Spirits*, *Volatile Salts*, and *Resins* of Vegetables and Animals, are much more efficacious Remedies than the *Galenical* Preparations of those self-same Medicines. Nay, though they are not easily reconciled to Mineral Preparations, because the Ancients not knowing how to separate them from their grosser Fæces, durst very seldom apply them to any but Chirurgical Uses; yet they themselves are forced to own, that some Diseases are of so malignant a Nature, that they

they cannot be dispelled by milder Methods. The Use of *Mercury* in Venereal Distempers, is so great, and so certain, that if there be such a Thing as a Specific Remedy in Nature, it may justly deserve that Title. The Unskilfulness of those who have prepared and administered Antimonial Medicines, has made them infamous with many Persons, though many admirable Cures have been, and are wrought by them, skilfully corrected, every Day. And it is well known, that the inward Use of Steel has been so successful, that in many Diseases, where the nicest Remedies seem requisite, whether the Constitution of the Patients, or the Nature of the Distempers, be considered, it is, without Fear, made use of; tho' its Medicinal Virtues, in these Cases, have been found out by Chymical Methods.

Upon the whole Matter, it is certain, that here is a new and gainful Acquisition made: The old *Galenical Materia Medica* is almost as well known, in all probability, as ever it was; since there are so great Numbers of Receipts preserved in the Writings of the old Physicians. The Industry of Modern Naturalists has, in most, at least, in all material Cases, clearly discovered what those Individual Remedies

Remedies are, which are there described. So that whatsoever Enlargement is made, is a clear Addition; especially, since these Minerals and Metals were then as free and common as they are now. Besides, vast Numbers of *Galenical* Medicines, Chymically prepared, are less nauseous, and equally powerful; which is so great an Advantage to Physick, that it ought not to be over-looked.

CHAP. XVII.

Of Ancient and Modern Anatomy.

(q) Corn.
Celsus in
Præfatio-
ne.

A *Natomy* is one of the most necessary Arts to open to us Natural Knowledge of any that was ever thought of. Its Usefulness to Physicians was very early seen; and the *Greeks* took great Pains to bring it to Perfection. Some of the first Dissectors (q) tried their Skill upon living Bodies of Men, as well as Brutes. This was so inhumane and barbarous a Custom, that it was soon left off: And it created such an Abhorrence in Mens Minds of the Art it self, that in *Galen's* Time even dead Bodies were seldom opened; and he was often obliged

liged (r) to use Apes instead of Men, which sometimes led him into great Mistakes.

(r) Anat.
Admini-
strat. pas-
sim.

It may be said, perhaps, that because there is not an ancient System of Anatomy extant, therefore the Extent of their Knowledge in this particular cannot be known. But the numerous Anatomical Treatises of *Galen* do abundantly supply that Defect. In his elaborate Work of *the Uses of the Parts of Humane Bodies*, he gives so full an Idea of ancient Anatomy, that if no other ancient Book of Anatomy were extant, it alone would be sufficient for this purpose. He is very large in all his Writings of this Kind, in taking Notice of the Opinions of the Anatomists that were ancients than himself, especially when they were mistaken, and had spent much Time and Pains in opening Bodies of Brutes, of which he somewhere promises to write a comparative Anatomy. So that his Books not only acquaint us with his own Opinions, but also with the Reasonings and Discoveries of *Hippocrates*, *Aristotle*, *Herophilus* and *Erasistratus*, whose Names were justly venerable for their Skill in these things. Besides, he never contradicts any Body without appealing to Experience, wherein though he was now and then

then mistaken, yet he does not write like a Pedant, affirming a thing to be true or false upon the Credit of *Hippocrates*, or *Herophilus*, but builds his Argument upon Nature as far as he knew her. He had an excellent Understanding, and a very piercing Genius, so that the false uses which he very frequently assigns to several Parts, do certainly shew that he did not understand the true Texture of those Parts, because where his Anatomy did not fail him, his Ratiocinations are, generally speaking, exact. Wherefore in this particular his Mistakes instruct us as effectually in the Ancients Ignorance, as his true Notions do in their Knowledge. This will appear at large hereafter, where it will be of mighty use to prove, That the Ancients cannot be supposed to have known many of the most eminent Modern Discoveries, since if they had known them, they would not have assigned such Uses to those Parts, as are not reconcilable to those Discoveries. If *Galen* had known that the Pancreas had been a Heap of small Glands, which all emit into one common Canal, a particular Juice carried afterwards through that Canal into the Guts; which there meeting with the Bile goes forwards, and assists it in the making of the Chyle, he would.

would never have said (*f*) that Nature made it for a Pillow to support the Veins; which go out of the Liver in that Place, where they divide into several Branches, lest if they had been without a Rest, they should have been hurt by the violent Eruption of the Blood; and this too without the assigning any other Use for it.

(*f*) De usu
Partium,
lib. V.
cap. 2.

By *Anatomy* there is seldom any thing understood but the Art of laying open the several Parts of the Body with a Knife, that so the Relation which they severally bear each to other may be clearly discerned. This is generally understood of the *containing* Parts, Skin, Flesh, Bones, Membranes, Veins, Arteries, Muscles, Tendons, Ligaments, Cartilages, Glands, Bowels, wherein only the Ancients busied themselves: As for the Examination of the Nature and particular Texture of the *contained* Parts, Blood, Chyle, Urine, Bile, Serum, Fat, Juices of the Pancreas, Spleen and Nerves, Lympha, Spittle, Marrow of the Bones, Mucilages of the Joints, and the like; they made very few Experiments, and those too for want of Chymistry very imperfect. The Discoveries therefore which have been made in that nobler part, which are numerous and considerable, are in a manner wholly owing to later Ages. In the other, a

O

great

great deal was anciently done, though a great deal more was left for Posterity to do.

I shall begin with the Body in general. It is certain that all the great Divisions of the Bones, Muscles, Veins and Arteries; most of the visible Cartilages, Tendons and Ligaments, were very exactly known in *Galen's* Time; the Positions of the Muscles, their several Originations, the Insertions of their Tendons, and investing Membranes, were, for the most part, traced with great Nicety and Truth; the more conspicuous pairs of Nerves which arise either from the Brain or Spinal Marrow, were very well known and carefully followed; most of the great Branches of the Veins and Arteries; almost all the Bones and Cartilages, with very many Muscles, have still old *Greek* Names imposed upon them by the Old Anatomists, or *Latin* Names translated from the *Greek* ones: So that, not only the easie things and such as are discernable at first Sight, were thoroughly known; but even several particulars, especially in the Anatomy of Nerves, were discovered, which are not obvious without great Care, and a good deal of practical Skill in dissecting. So much in general; from which it is evident, that as far as Anatomy is peculiarly useful to a Surgeon, to inform him

him how the Bones, Muscles, Blood-Vessels, Cartilages, Tendons, Ligaments and Membranes lie in the Limbs and more conspicuous Parts of the Body, so far the Ancients went: And here, there is very little that the Moderns have any Right to pretend to as their own Discoveries; though any Man, that understands these things, must own, That these are the first things which offer themselves to an Anatomist's View.

Here I shall beg Leave to descend to Particulars, because I have not seen any Comparison made between *Ancient and Modern Anatomy*, wherein I could acquiesce; whilst some, as Mr. *Glanville* (t), and some others who seem to have copied from him, have allowed the Ancients less than was their Due; others, as *Vander Linden* and *Almeloveen* (u), have attributed more to them than came to their Share; especially since (though perhaps it may be a little tedious, yet) it cannot be called a Digression.

Hippocrates (w) took the Brain to be a Gland. His Opinion was nearer to the Truth than any of his Successors; but he seems to have thought it to be a similar Substance, which it evidently is not. And therefore, when several Parts of it were discovered not to be glandulous,

(t) *Essay of Modern Improvements of useful Knowledge.*

(u) *Inventa Nov. Antiqua.*

(w) *De Glandulis pag. 418. S. 7. Edit. Vander Linden.*

his Opinion was rejected. *Plato* took it to be Marrow, such as nourishes the Bones; but its Weight and Texture soon destroyed his Notion, since it sinks in Water wherein Marrow swims; and is hardened by Fire, by which the other is melted.

(x) De usu
Partium,
lib. VIII.
cap. 6.

Galen (x) saw a little farther, and he asserts it to be of a nervous Substance, only something softer than the Nerves in the Body. Still they believed that the Brain was an uniform Substance, and as long as they did so, they were not like to go very far. The first Anatomist who discovered the true Texture of the Brain

(y) Mal-
pighius
Epist. de
Cerebro
ad Fracaf-
satum, p. 2.

was *Archangelus Piccolhomineus* (y) an *Italian*, who lived in the last Age. He found that the Brain properly so called, and *Cerebellum*, consist of Two distinct Substances, an outer Ash-coloured Substance, through which the Blood-Vessels which lie under the *Pia Mater* in innumerable Folds and Windings, are disseminated; and an inner every where united to it, of a nervous Nature, that joins this Bark (as it is usually called) to the *Medulla Oblongata*, which is the Original of all the Pairs of Nerves that issue from the Brain, and of the Spinal Marrow, and lies under the Brain and *Cerebellum*. After him

(z) Anat.
Cerebri.

Dr. *Willis* (z) was so very exact, that he traced this medullar Substance through all its

its Insertions into the Cortical, and the *Medulla Oblongata*, and examined the Rises of all the Nerves, and went along with them into every Part of the Body with wonderful Curiosity. Hereby not only the Brain was demonstrably proved to be the Fountain of Sense and Motion, but also by the Courses of the Nerves, the Manner how every Part of the Body conspires with any others to procure any one particular Motion, was clearly shewn; and thereby it was made plain even to Sense, that where-ever many parts joined at once to cause the same Motion, that Motion is caused by Nerves that go into every one of those Parts, which are all struck together. And though *Vieuassens* and *du Verney* have in many things corrected *Dr. Willis's Anatomy of the Nerves*; yet they have strengthened his general Hypothesis, even at the Time when they discovered his Mistakes, which is the same thing to our present purpose. *Galen*, indeed (a), had a right Notion of this matter, but he traced only the larger Pairs of Nerves, such as could not escape a good Anatomist.

(a) De
V. P. l. 8.
c. 4.

But the manner of the forming of the *Animal Spirit* in the Brain was wholly unknown. In Order to the Discovery whereof, *Malpighius* (b) by his Microscopes found that the Cortical Part of

(b) De
Cerebri
Cortice.

(c) De
Cerebro,
pag. 4.

(d) Galen
de V. P.
l. 8. c. 2.

the Brain consists of an innumerable Company of very small Glandules, which are all supplied with Blood by Capillary Arteries; and that the Animal Spirit, which is separated from the Mass of the Blood in these Glandules, is carried from them into the *Medulla Oblongata* through little Pipes, whereof one belongs to every Gland, whose other End is inserted into the *Medulla Oblongata*, and that these Numberless Pipes, which in the Brain of some Fishes look like the Teeth of a small Ivory Comb (c), are properly that which all Anatomists after *Piccolhomineus* have called the *Corpus callosum*, or the Medullar Part of the Brain. This Discovery destroys the Ancient Notions of the Uses of the Ventricles of the Brain, and makes it very probable that those Cavities are only Sinks to carry off excrementitious Humours, and not Store-Houses of the Animal Spirit: It shews likewise how little they knew of the Brain who believed that it was an uniform Substance. Some of the Ancients disputed (d) whether the Brain were not made to cool the Heart. Now though these are ridiculed by *Galen*, so that their Opinions are not imputable to those who never held them; yet they shew that these famous Men had examined these things very superficially:

cially : For no Man makes himself ridiculous if he can help it ; and now, that Mankind are satisfied by ocular Demonstration that the Brain is the Original of the Nerves, and the Principle of Sense and Motion, he would be thought out of his Wits that should doubt of this Primary use of the Brain, though formerly when things had not been so experimentally proved, Men might talk in the dark, and assign such Reasons as they could think of, without the Suspicion of being ignorant or impertinent.

The *Eye* is so very remarkable a Member, and has so many Parts peculiar to its self, that the Ancients took great Notice of it. They found its Humours, the watry, crystalline, and glassy, and all its Tunicles, and gave a good Description of them ; but the Optick Nerve, the aqueous Ducts which supply the watry Humour, and the Vessels which carry Tears were not enough examined. The first was done by Dr. Briggs (e), who has found that in the *Tunica Retiformis*, which is contiguous to the glassy Humour, the Filaments of the Optick Nerve there expanded, lie in a most exact and regular Order, all parallel one to another, which when they are united afterwards in the Nerve are not shuffled confusedly together,

(e) Theory of Vision. Grew's Transact. numb. 6, and Philos. Transact. numb. 147.

ther, but still preserve the same Order till they come to the Brain. The crystalline Humour had already been discovered to be of a Double-Convex Figure, made of Two unequal Segments of Spheres, and not perfectly spherical as the Ancients thought. So that this further Discovery made by Dr. Briggs, shews evidently why all the Parts of the Image are so distinctly carried to the Brain, since every Ray strikes upon a several Filament of the Optick Nerve, and all those strings so struck are moved equably at the same Time. For want of knowing the Nature and Laws of Refraction, which have been exactly stated by Modern Mathematicians, the Ancients discoursed very lamely of Vision. This made *Galen* think that the crystalline Humour (*f*) was the Seat of Vision, whose only Use is to refract the Rays, as the known Experiment of a dark Room, with one only Hole to let in Light, through which a most exact Land-skip of every thing without, will be represented in its proper Colours, Heights and Distances, upon a Paper placed in the Focus of the Convex Glass in the Hole, which Experiment is to be found in almost every Book of Opticks, does plainly prove. Since the same thing will appear, if the crystalline

(f) De usu
Partium,
lib. VIII.
cap. 6.

stalline Humour taken out of an Ox's or a Man's Eye, be placed in the Hole instead of the Glass. The Way how the watry Humour of the Eye, when by Accident lost, may be and is constantly supplied, was first found out and described by Monsieur *Nuck* (g), who discovered a particular Canal of Water arising from the internal Carotidal Artery, which creeping along the Sclerotic Coat of the Eye, perforates the Cornea near the Pupil, and then branching its self curiously about the Iris, enters and supplies the watry Humour. As to the Vessels which moisten the Eye, that it may move freely in its Orbit, the Ancients knew in general that there were Two Glands in the Corners of the Eyes (h); but the Lympheducts, through which the Moisture is conveyed from those Glands were not fully traced till *Steno* (i) and *Briggs* (k) described them; so that there is just the same Difference between our Knowledge and the Ancients in this particular, as there is between his Knowledge who is sure there is some Road or other from this Place to that, and his who knows the whole Course, and all the Turnings of the Road, and can describe it on a Map.

(g) De Ductibus novis Aquosis

(h) Galen de V. P. lib. X. c. II.

(i) Observat. Anatomicae de Oris Oculorum & Narium Vasis.

(k) Ophthalmographia.

The

The Instruments by which Sounds are conveyed from the *Drum* to the *Auditory Nerves* in the inner Cavities of the *Ear*, were very little, if at all, known to the Ancients. In the First Cavity there are Four small Bones, the *Hammer*, the *Anvil*, the *Stirrup*, and a small flattish Bone just in the Articulation of the *Anvil* and the *Stirrup*. It is now certainly known, that when the Drum is struck upon by the external Air, these little Bones, which are as big in an Infant as in adult Persons, move each other; the Drum moves the Hammer, That the Anvil, That the Stirrup, which opens the oval Entrance into the Second Cavity: None of these Bones were ever mentioned by the Ancients, who only talked of Windings and Turnings within the *Os Petrosum*, that were covered by the large Membrane of the Drum. *Jacobus Carpus*, one of the first Restorers of Anatomy in the last Age, found out the *Hammer* and the *Anvil*, *Realdus Columbus* discovered the *Stirrup*, and *Franciscus Sylvius* the little flattish Bone, by him called *Os Orbiculare*; but mistook its Position: He thought it had been placed Sideways of the Head of the *Stirrup*, whereas Monsieur *du Verney* (1) finds that it lies in the Head of the *Stirrup*, between that and the *Anvil*. The other

(1) Traité
del' Orga-
nes de l'
Ouye. Pa-
ris, 1683.

other inner Cavities were not better understood, the spiral Bones of the *Cochlea*, that are divided into Two distinct Cavities, like Two pair of Winding-Stairs parallel to one another, which turn round the same Axis, with the Three semicircular *Canals* of the *Labyrinthus*, into which the inner Air enters, and strikes upon the small Twigs of the Auditory Nerves inserted into those small Bones, were things that they knew so little of that they had no Names for them ; and indeed till Monsieur *du Verney* came, those Mazes were but negligently, at least unsuccessfully, examined by Moderns as well as Ancients ; it being impossible so much as to form an Idea of what any former Anatomists asserted of the wonderful Mechanism of those little Bones, before he wrote, if we set aside Monsieur *Per-*
rault's (m) *Anatomy* of those Parts, which came out a Year or two before ; who is not near so exact as Monsieur *du Ver-*
ney.

(m) *Essays*
de Physi-
que,
Part II.

The other Parts of the Head and Neck, wherein the *Old Anatomy* was the most defective, were the *Tongue* as to its internal Texture, and the *Glands of the Mouth*, *Jaws* and *Throat*. The Texture of the *Tongue* was but guessed at, which occasioned great Disputes concerning the Na-
 ture

(n) *Vide*
Malpighi-
um de Lin-
guâ.

ture of its Substance, (n) some thinking it to be glandulous, some muscular, and some of a peculiar Nature, not to be matched in any other part of the Body. This therefore, *Málpighius* examined with his Glasses, and discovered, that it was cloathed with a double Membrane ; that in the inner Membrane there are Abundance of small Papillæ, which have extremities of Nerves inserted into them, by which the Tongue discerns Tasts, and that under that Membrane it is of a muscular Nature consisting of numberless Heaps of Fibres which run all manner of Ways over one another like a Mat.

The general Uses of *the Glands of the Mouth, Jaws and Neck* were anciently known ; it was visible that the Mouth was moistend by them, and the Mass of the Spittle supplied from them ; and then, having named them from the Places near which they lie, as the *Palate*, the *Jaws*, the *Tongue*, the *Ears*, the *Neck*, they went no further ; and there was little, if any thing, more done, till Dr. *Wharton*, and *Nicolaus Steno* examined these Glands. And upon an exact Enquiry Four several Salival Ducts have been discovered, which from several Glands discharge the Spittle into the Mouth. The First was described by Dr. *Wharton* (o) near Forty Years ago :

(o) *Ade-*
nograph.
cap. 21.

ago: it comes from the *conglomerate Glands* that lie close to the inner side of the lower Jaw, and discharges it self near the middle of the Chin into the Mouth.

The Second was found out by *Steno* (p) (p) Observat. Anat. de Oris Vasis. who published his Observations in 1662; this comes from those Glands that lie near

the Ears, in the inside of the Cheek, and the outside of the upper-Jaw: The Third was found out (q) by *Thomas Bartholin*, (q) Nuck Sialograp. who gave an Account of it in 1682, and

about the same Time by one *Rivinus* a German: It arises from the Glands under the Tongue, and going in a distinct Canal to the Mouth of *Wharton's Duct*, there, for the most Part, by a common Orifice, opens into the Mouth. The Fourth was discovered by Monsieur *Nuck* (r); he found a Gland within the (r) Ibid. Orbit of the Eye, from which, not far from the Mouth of *Steno's Duct*, Spittle is supplied to the Mouth by a peculiar Canal. Besides these, the same Monsieur *Nuck* found some smaller Glands near the last, but lower down, which by Four distinct Pipes carry some Spittle into the Mouth; so careful has Nature been to provide so many Passages for that necessary and noble Juice, that if some should fail, others might supply their Want.

CHAP. XVIII.

Of the Circulation of the Blood.

FROM the *Head*, we are to look into the *Thorax*, and there to consider the *Heart*, and the *Lungs*. The *Lungs*, as most of the other *Viscera*, were believed to be of a *Parenchymous* Substance, till (1) *Epist. de Pulmo-*
nibus. *Malpighius* found by his Glasses (2) that they consist of innumerable small Bladders, that open into each other, as far as the outermost; which are covered by the outer Membrane, that incloses the whole Body of the *Lungs*: And that the small Branches of the *Wind-Pipe* are all inserted into these Bladders; about every one of which the *Veins* and *Arteries* are entwined, in an unconceivable Number of Nets and Mazes; that so the inspired Air may press upon, or mix with, the Mass of Blood, in such small Parcels as the Ancients had no Notion of. The *Wind-Pipe* also it self is nourished by an *Artery* that creeps up the Back-side, and accompanies it in all its Branchings: Which was first found out by *Frederic Ruysch*, a *Dutch* Professor of *Anatomy* at *Leyden*, about Thirty Years ago.

But

But the great Discovery that has been made of the *Lungs*, is, That the whole Mass of Blood is carried out of the Right Ventricle of the Heart, by the *Arteria Pulmonaris*, called anciently *Vena Arteriosa*, through all the small Bladders of the *Lungs*, into the *Vena Pulmonaris*, (or *Arteria Venosa*;) and from thence, into the Left Ventricle of the Heart again. So that the Heart is a strong Pump, which throws the Blood, let in from the Veins, into the Lungs; and from the Lungs, afterwards, into the Arteries; and this by a constant rapid Motion, whereby the Blood is driven round in a very few Minutes. This Discovery, first made perfectly intelligible by Dr. *Harvey*, is of so very great Importance to shew the Communication of all the Humours of the Body, each with other, that as soon as Men were perfectly satisfied that it was not to be contested, which they were in a few Years, a great many put in for the Prize, unwilling that Dr. *Harvey* should go away with all the Glory. *Vander Linden*, who published a most exact Edition of *Hippocrates*, in *Holland*, about Thirty Years ago, has taken a great deal of Pains to prove that *Hippocrates* knew the *Circulation of the Blood*, and that Dr. *Harvey* only revived it. The Sub-

Substance of what has been said in this

(t) Παρεργονέκον ἐν
τῇ νόσῳ διὰ παντός,
ἅτε τὰ αἵματά ἐφθαρ-
μένε, τε καὶ ἐκκεκινημένε
τὴν εἰωθυῖαν κίνησιν. De
Morbis, lib. 1. §. 30.
Edit. Vand.

(u) Αὐταὶ πηγαὶ φύ-
σις ἀνθρώπου, καὶ οἱ πο-
ταμοὶ ἐνταῦθα ἀνὰ τὸ
σῶμα, τοῖσιν ἀρδεῖ τὸ
σῆμα. ἔτοι γὰρ καὶ ζώ-
ων φέρουσι τὸν ἀνθρώπον.
καὶ ἀνὰ τὴν αἵματι ἀπέδα-
νεν ὁ ἀνθρώπος, De
Corde, §. 5.

(w) Αἱ φλέβες διὰ
τὰ σῶμα καὶ κεφάλαια,
πνεῦμα, καὶ ρεῦμα καὶ
κίνησιν παρέχον, ἀπὸ
μῆς πολλὰ διαβλασά-
ναι καὶ αὐτὴ μὲν ἡ
ρεία, ὅθεν ἦρκε, καὶ ἡ
τετελεύτηκεν, ἐκ οἷδα,
κύκλος γὰρ γεγενημένος, ἀρ-
χὴ ἐκ εὐρέδης. De Venis,
§. 17.

Matter, is this ; that *Hippocrates* speaks (t) in one Place, of the Usual and Constant Motion of the Blood : That in another Place, he calls (u) the Veins and Arteries the Fountains of Humane Nature, the Rivers that water the whole Body, that convey Life ; and which, if they be dried up, the Man dies : That in a Third Place, he says, (w) That the Blood-Vessels, which are dispersed over the whole Body, give Spirit, Moisture and Motion, and all spring from one ; which one (Blood-Vessel) has no Beginning, nor no End, that I can find ; for, where there is a Circle, there is no Beginning. These are the clearest Passages that are produced, to prove,

that *Hippocrates* knew the Circulation of the Blood ; and it is plain from them, that he did believe it as an *Hypothesis* ; that is, in plain English, that he did suppose the Blood to be carried round the Body by a constant accustomed Motion : But that he did not know what this constant accustomed Motion was ; and that he had not found

found that Course which, in our Age, Dr. *Harvey* first clearly demonstrated, will appear evident from the following Considerations: (1.) He says nothing of the *Circulation of the Blood* in his *Discourse of the Heart*, where he Anatomizes it as well as he could; and speaks of (x) the Ventricles, and the Valves (y), which are the immediate Instruments by which the Work is done. (2.) He believes that the Auricles of the Heart (z) are like Bellows, which receive the Air to cool the Heart. Now there are other Uses of them certainly known, since they assist the Heart in the Receiving of the Blood from the *Vena Cava*, and the *Vena Pulmonaris*. This cannot be unknown to any Man that knows how the Blood circulates; and accordingly, would have been mentioned by *Hippocrates*, had he known of it. (3.) *Hippocrates* speaks of Veins (a), as receiving Blood from the Heart, and going from it: Which also was the constant Way of Speaking of *Galen*, and all the Ancients. Now, no Man that can express himself properly, will ever say, That any Liquors are carried away from any Cistern, as from a Fountain or Source, through those Canals which,

(x) De
Corde,

§. 4.

(y) Ibid:

§. 7, 8.

(z) Ib. §. 6.

(a) *Arteriæ quidem purum sanguinem & spiritum à corde recipiunt; Venæ autem & ipsæ à corde sanguinem sumunt, per quas corpori distribuitur; De Structura Hominis, §. 2.*

(b) De
Corde,
§. 10.

to his Knowledge, convey Liquors to that Cistern. (4.) *Hippocrates* says, the Blood is carried into the Lungs, from the Heart, for the Nourishment of the Lungs; without assigning any other Reason (b). These seem to be positive Arguments, that *Hippocrates* knew nothing of this Matter; and accordingly, all his Commentators, Ancient and Modern, before Dr. *Harvey*, never interpreted the former Passages of the *Circulation of the Blood*: Neither would *Vander Linden*, in all probability, if Dr. *Harvey* had not helped him to the Notion; which he was then resolved to find in *Hippocrates*, whom he supposed not the Father only, but the Finisher also of the whole Medical Art. It is pretended to by none of the Ancients, or rather their Admirers for them, after *Hippocrates*. As for *Galen*, any Man that reads what he says of the Heart and Lungs, in the 6th. Book of his *De Usu Partium*, must own, that he does not discourse as if he were acquainted with Modern Discoveries; and therefore it is not so much as pretended that he knew this Recurrent Motion of the Blood. Which also further shews, that if *Hippocrates* did know it, he explained himself so obscurely, that *Galen* could not understand him; who, in all probability, understood *Hippocrates's* Text

Text as well as any of his Commentators, who have written since the Greek Tongue; and much more, since the Ionic Dialect has ceased to be a living Language.

Since the Ancients have no Right to so noble a Discovery, it may be worth while to enquire, to whom of the Moderns the Glory of it is due; for this is also exceedingly contested. The first Step that was made towards it, was, the finding that the whole Mass of the Blood passes through the Lungs, by the Pulmonary Artery and Vein.

The first that I could ever find, who had a distinct Idea of this Matter, was Michael Servetus, a Spanish Physician, who was burnt for Arianism, at Geneva, near 140 Years ago. Well had it been for the Church of Christ, if he had wholly confined himself to his own Profession! His Sagacity in this Particular, before so much in the dark, gives us great Reason to believe, that the World might then have had just Cause to have blessed his Memory. (c) In a Book of his, intituled, *Christianismi Restitutio*,
(c) Vitalis Spiritus in sinistro cordis ventriculo suam Originem habet, juvantibus maxime pulmonibus ad ipsius generationem. Est spiritus tenuis, caloris vi elaboratus, flavo colore, igneâ potentiâ, ut sit quasi ex puriore sanguine lucidus, vapor: generatur ex facta in pulmone mixtione inspirati aeris cum elaborato subtili sanguine, quem dexter ventriculus sinistro communicat. Fit autem communicatio hæc non per parietem cordis medium ut vulgo creditur, sed magno artificio à dextro cordis ventriculo, longo per pulmones ductu, agitatur sanguis subtilis; à pulmonibus præparatur; flavus ejicitur, & à venâ arteriosâ in arteriam venosam transfunditur; deinde in ipsâ arteriâ venosâ inspirato aëre miscetur & expiratione à fuligine repurgatur; atque ita tandem à sinistro cordis ventriculo totum mixtum per diastolen attrahitur, apta supellex ut fiat spiritus vitalis. Servet. Christian. Restit.

printed in the Year MDLIII. he clearly asserts, that the Blood passes through the Lungs, from the Left to the Right Ventricle of the Heart ; and not through the *Partition* which divides the two Ventricles, as was at that Time commonly believed. How he introduces it, or in which of the Six Discourses, into which *Servetus* divides his Book, it is to be found, I know not, having never seen the Book my self. Mr. *Charles Bernard*, a very learned and eminent Chirurgeon of *London*, who did me the Favour to communicate this Passage to me, (set down at length in the Margin) which was transcribed out of *Servetus*, could inform me no further, only that he had it from a learned Friend of his, who had himself copied it from *Servetus*.

(d) Dux in-
sunt cordi
cavitates,
h. e. ven-
triculi duo;
ex his alter
à dextris
est: à sini-
stris alter;

Realdus Columbus, of *Cremona*, was the next that said any thing of it, in his *Anatomy*, printed at *Venice*, 1559. in *Folio*; and at *Paris*, in 1572. in *Octavo*; and afterwards elsewhere. There he asserts the same (d) Circulation through the dexter sinistro multò est major; in dextro sanguis adest naturalis, ac vitalis in sinistro: illud autem observatu perpulchrum est, substantiam cordis dextrum ventriculum ambientem tenuem satis esse, sinistram vero crassam; & hoc tum æquilibrii causâ factum est, tum ne sanguis vitalis, qui tenuissimus est, extra resudaret. Inter hos ventriculos septum adest, per quod fere omnes existimant sanguini à dextro ad sinistram aditum patefieri; id ut fiat facilius, in transitu ob vitalium spirituum generationem tenuem reddi: sed longâ errant viâ: nam sanguis per arteriosam venam ad pulmonem fertur, ibique attenuatur; deinde cum aëre unâ per arteriam venalem ad sinistram cordis ventriculum defertur; quod nemo hætenus aut animadvertit, aut scriptum reliquit. *Reald. Columb. Anat. lib. vii. p. 325. Edit. Lut.*

Lungs,

Lungs, that *Servetus* had done before ; but says, that no Man had ever taken notice of it before him, or had written any Thing about it : Which shews that he did not copy from *Servetus* ; unless one should say, that he stole the Notion, without mentioning *Servetus's* Name ; which is injurious, since in these Matters the same Thing may be, and very often is observed by several Persons, who never acquainted each other with their Discoveries. But *Columbus* is much more particular ; (e) for he says, That the Veins lodge the whole Mass of the Blood in the *Vena Cava*, which carries it into the Heart, whence it cannot return the same Way that it went ; from the Right Ventricle it is thrown into the Lungs by the Pulmonary Artery, where the Valves are so placed as to hinder its Return that Way into the Heart, and so it is thrown into the Left Ventricle, and by the *Aorta* again, when enliven'd by the Air, diffused through the whole Body.

(e) Idcirco quando dilatatur, sanguinem à cavâ venâ in dextrum ventriculum suscipit, nec non ab arteriâ venosâ sanguinem paratum ut diffundimus unâ cum aëre in sinistrum :

propterea membranæ illæ demittuntur & ingressui cedunt : nam cum cor coarctatur, hæ clauduntur ; ne quod susciperetur per easdem vias retrocedat ; eodémque tempore membranæ tum magnæ arteriæ, tum venæ arteriosæ recluduntur, aditumque præbent spirituofo sanguini exeunti, qui per universum corpus funditur, sanguinique naturali ad pulmones delato. Res itaq; semper habet, cum dilatatur, quas prius memoravimus, recluduntur, clauduntur reliquæ ; itaque comperies sanguinem qui in dextrum ventriculum ingressus est, non posse in cavam venam retrocedere. Ibid. pag. 330. Vide quoque lib. xi. pag. 411.

Some Years after appeared *Andreas Cæsalpinus*, who printed his *Peripatetical Questions* at *Venice*, in *Quarto*, in 1571. And afterwards with his *Medical Questions*, at the same Place, in 1593. He is rather more particular than *Columbus*, especially in examining how Arteries and Veins joyn at their Extremities; which he supposes to be by opening their Mouths into each other: And he uses the Word *Circulation* in his *Peripatetical Questions*, which had never been used in that Sence before. He also takes notice, that the Blood swells below the Ligature in veins, and urges that in Confirmation of his Opinion.

At last, Dr. *William Harvey* printed a Discourse on purpose, upon this Subject, at *Francfort*, in 1628. This Notion had only been occasionally and slightly treated of by *Columbus* and *Cæsalpinus*, who themselves, in all probability, did not know the Consequence of what they asserted; and therefore it was never applied to other Purposes, either to shew the Uses of the other *Viscera*, or to explain the Natures of Diseases: Neither, for any Thing that appears at this Day, had they made any Numbers of Experiments, which were necessary to explain their Doctrine, and to clear it from Opposition.

position. All this Dr. *Harvey* undertook to do ; and with indefatigable Pains, traced the visible Veins and Arteries throughout the Body, in their whole Journey *from* and *to* the Heart ; so as to demonstrate, even to the most incredulous, not only that the Blood circulates through the Lungs and Heart, but the very Manner how, and the Time in which that great Work is performed. When he had once proved that the Motion of the Blood was so rapid as we now find it is, then he drew such Consequences from it, as shewed that he thoroughly understood his Argument, and would leave little, at least, as little as he could, to future Industry to discover in that particular Part of Anatomy. This gave him a just Title to the Honour of so noble a Discovery, since what his Predecessors had said before him was not enough understood, to form just Notions from their Words. One may also observe how gradually this Discovery, as all abstruse Truths of Humane Disquisition, was explained to the World. *Hippocrates* first talked of the *Usual Motion* of the Blood. *Plato* said, That the *Heart* was the *Original* of the *Veins*, and of the *Blood*, that was carried about every Member of the Body. *Aristotle* also somewhere speaks of a *Recurrent*

rent Motion of the Blood: Still all this was only *Opinion* and *Belief*: It was rational, and became Men of their Genius's; but, not having as yet been made evident by Experiments, it might as easily be denied as affirmed. *Servetus* first *saw* that the Blood passes through the Lungs; *Columbus* went further and shew'd the Uses of the *Valves* or *Trap-doors* of the Heart, which let the Blood *in* and *out* of their Respective Vessels, but not the self same Road: Thus the Way was just open when *Dr. Harvey* came, who built upon the First Foundations; to make his Work yet the easier, the Valves of the Veins which were discovered by *F. Paul* the *Venetian*, had not long before been explained by *Fabricius ab Aqua pendente*, whence the Circulation was yet more clearly demonstrated.

There was one thing still wanting to compleat this Theory, and that was the Knowledge how the Veins received that Blood which the Arteries discharged; first it was believed that the Mouths of each sort of Vessels joined into one another; that Opinion was soon laid aside, because it was found that the capillary Vessels were so extremely small, that it was impossible with the naked Eye to trace them. This put them upon imagining

gining that the Blood ouzes out of the Arteries, and is absorbed by the Veins, whose small Orifices receive it, as it lies in the Fibres of the Muscles, or in the Parenchyma's of the Bowels: Which Opinion has been generally received by most Anatomists since Dr. *Harvey's* Time. But Monsieur *Leeuwenhoek* has lately found in several sorts of Fishes (f), which were more manageable by his Glasses than other Animals, That Arteries and Veins are really continued Syphons variously wound about each other towards their Extremities in numberless Mazes, over all the Body; and others have found (g) what he says to be very true in a Water Newt. So that this Discovery has passed uncontested. And since it has been constantly found, that Nature follows like Methods in all sorts of Animals, where she uses the same sorts of Instruments, it will always be believed, That the Blood circulates in Men after the same Manner as it does in *Eels, Perches, Pikes, Carps, Bats*, and some other Creatures, in which Monsieur *Leeuwenhoek* tried it. Though the Ways how it may be visible to the Eye in Men, have not, that I know of, been yet discovered. However this visible *Circulation of the Blood* in these Creatures effectually removes Sir *William Temple's* Scruple,

(f) Letter
65, 66.

(g) Philos.
Transact.
numb. 177.

Scruple, who seems unwilling to believe the *Circulation of the Blood*, because he (h) 44,45. could not see it. His Words are these (h): *Nay it is disputed whether Harvey's Circulation of the Blood be true or no, for though Reason may seem to favour it more than the contrary Opinion; yet Sense can very hardly allow it, and to satisfy Mankind both these must concurr.* Sense therefore here allows it, and that this *Sense* might the sooner concurr, Monsieur *Leeuwenhoek* describes the Method how this Experiment may be tried in his 66th. Letter: The Inferences that may be made from this Noble Discovery are obvious, and so I shall not stay to mention them.

CHAP. XIX.

Further Reflections upon Ancient and Modern Anatomy.

IF after this long Enquiry into the First Discovery of the *Circulation of the Blood*, it should be found that the *Anatomy of the Heart* was but slightly known to the Ancients, it will not, I suppose, be a Matter of any great Wonder. The First Opinion which we have of the Texture (i) De of the Heart, was that of *Hippocrates* (i), Corde, §.4. that

that it is a very strong Muscle ; this tho' true was rejected afterwards for want of knowing its true Use ; its internal Divisions, its Valves, and larger visible Fibres were well known and distinctly described by the Ancients ; only they were mistaken in thinking that there is a Communication between the Ventricles through the *Septum*, which is now generally known to be an Errour. The Order of the Muscular Fibres of the Heart was not known before Dr. *Lower*, who discovered them to be Spiral like a Snail-Shell, as if several Skains of Threads of differing Lengths had been wound up into a Bottom of such a Shape, hollow, and divided within. By all these Discoveries

Alphonsus Borellus (k) was enabled to give such a Solution of all the Appearances of the Motion of the Heart, and of the Blood in the Arteries, upon Mathematical and Mechanical Principles, as will give a more satisfactory Account of the wonderful Methods of Nature in dispensing Life and Nourishment to every Part of the Body, than all that had ever been written upon these Subjects before those things were found out.

(k) De Motu Animalium, Part II. cap. 5.

Below the *Midriff* are several very noble *Viscera* : The *Stomach*, the *Liver*, the *Pancreas* or *Sweet-Bread*, the *Spleen*, the *Reins*,

Reins, the Intestines, the Glands of the Mesentery, and the Instruments of Generation of both Sexes; in the Anatomical Knowledge of all which Parts, the Ancients were exceedingly defective.

(1) Pharmaceut.
Rational.

The *Coats of the Stomach* have been separated, and the several Fibres of the middle Coat examined by Dr. *Willis* (1) with more Exactness than formerly; he also has been very nice in tracing the Blood-Vessels and Nerves that run amongst the Coats, has evidently shewn that its Inside is covered with a glandulous Coat, whose Glands separate that Mucilage; which both preserves the Fibres from being injured by the Aliments which the Stomach receives, and concurs with the Spittle to further the Digestion there performed; and has given a very particular Account of all those several Rows of Fibres, which compose the musculous Coat: To which if we add *Steno's* Discovery of the Fibres of the musculous Coat of the Gullet, that they are spiral in a double Order, one ascending, the other descending, which run contrary Courses, and mutually cross each other in every Winding; with Dr. *Cole's* (m) Discovery of the Nature of the Fibres of the Intestines, that they also move spirally, though not, perhaps, in a contrary Order,

(m) Philos.
Transf.
numb. 125.

der, from the beginning of the *Duodenum* to the end of the streight Gut, the Anatomy of those parts seems to be almost compleat.

The great Use of *the Stomach* and *the Guts*, is to prepare the Chyle, and then to transmit it through the Glands of the Mesentery into the Blood; this the Ancients knew very well; the Manner how it was done they knew not. *Galen* (n) (n) De
held that the Mesaraick Veins, as also Ufu Parti-
those which go from the Stomach to the um, lib. 4.
Liver, carry the Chyle thither, which by cap. 2, 3,
the Warmth of the Liver is put into a 4, 5.
Heat, whereby the Fæculencies are separated from the more spirituous Parts, and by their Weight sink to the Bottom; the purer Parts go into the *Vena Cava*. The Dregs which are of two sorts, *Choler* and *Melancholy*, go into several Receptacles; the *Choler* is lodged in the Gall-Bladder and *Porus Bilaris*: *Melancholy* is carried off by the Spleen. The Original of all these Notions was Ignorance of the Anatomy of all these Parts, as also of the constant Motion of the Blood through the Lungs and Heart. *Herophilus*, who is commended as the ablest Anatomist of Antiquity, found out (o) that there were (o) De U.
Veins dispersed quite through the Mesen- P. lib. 4.
tery, as far as the small Guts reach, which c. 19.
carried

carried the Chyle from the Intestines into several *Glandulous Bodies*, and there lodged them. These are the *Milky Veins* again discovered by *Asellius* about Fifty Years ago, and those Glands which *Herophilus* spoke of, are probably that great Collection of Glands in the Mesentery that is commonly called the *Pancreas Asellii*. After *Herophilus* none of the Ancients had the Luck to trace the Motions of the Chyle any further, and so these milky Veins were confounded with the Mesaraicks, and it was commonly believed, That because all Mesaraicks carry the Blood from the Intestines into the Liver, therefore they carried Chyle also when there was any Chyle to carry; and hence probably it was that the Liver was believed to be the common Work-House of the Blood. But when *Asellius* had traced the Chyle as far as the great Gland of the Mesentery, it was soon found not to lie there. And *Pecquet*, about Forty Years since, discovered the *common Receptacle of the Chyle*, whither it is all brought. Thence he also found that it is carried, by particular Vessels through the Thorax, almost as high as the Left-Shoulder, and there thrown into the Left Subclavian Vein, and so directly carried to the Heart. It has also been discovered that in his Canal,
usually

usually called *Ductus Thoracicus*, there are numerous Valves, which hinder the Return of the Chyle to the common Receptacle, so that it can be moved forwards, but not backwards.

Since this Passage of the Chyle has been discovered, it has been by some believed, that the *Milk* is conveyed into the Breasts, by little Vessels, from the *Ductus Thoracicus*. The whole Oeconomy of that Affair has been particularly described very lately by Mr. *Nuck*; before whose Time it was but imperfectly known. He says therefore, that the Breasts are Heaps of Glands, supplied with Blood by innumerable Ramifications of the Axillary and Thoracick Arteries; some of which passing through the Breast-bone, unite with the Vessels of the opposite Side. These Arteries, which are unconceivably small, part with the Milk in those small Glands, into small Pipes, four or five of which meeting together, make one small Trunk; of these small Trunks, the large Pipes, which terminate in the Nipple, are made up; though before they arrive thither, they straiten into so small a Compass, that a stiff Hair will just pass through. The Nipple, which is a Fibrous Body, has seven or eight, or more Holes, through which every Pipe emits its Milk upon Suction;

Suction; and, lest any one of them being stopped, the Milk should stagnate, they all have cross Passages into each other, at the Bottom of the Nipple, where it joyns to the Breast.

The fore-mentioned Discovery of the Passage of the Chyle obliged Men to re-examine the Notions which, till then, had generally obtained, concerning the Nature and Uses of the *Liver*. Hitherto it had been generally believed, that the Blood was made there, and so dispersed into several Parts, for the Uses of the Body, by the *Vena Cava*. *Erasistratus*, indeed, supposed (p) that its principal Use was, to separate the Bile, and to lodge it in its proper Vessels: But, for want of further Light, his Notion could not then be sufficiently proved; and so it presently fell, and was never revived, till *Asellius's* and *Pecquet's* Discoveries put it out of doubt. Till *Malpighius* discovered its Texture by his Glasses, its Nature was very obscure. But he has found out, (1.) That the Substance of the Liver is framed of innumerable Lobules, which are very often of a Cubical Figure, and consist of several little Glands, like the Stones of Raisins; so that they look like Bunches of Grapes, and are each of them cloathed with a distinct Membrane. (2.) That

(p) Galen
de U. P.
lib. 4.
cap. 13.

(2.) That the whole Bulk of the Liver consists of these Grape-stone-like Glands, and of divers sorts of Vessels. (3.) That the small Branches of the *Cava*, *Porta*, and *Porus Biliaris*, run through all, even the least of these Lobules, in an equal Number; and that the Branches of the *Porta* are as Arteries that convey the Blood *to*, and the Branches of the *Cava* are the Veins which carry the Blood *from* all these little Grape-stone-like Glands. From whence it is plain, that the Liver is a Glandulous Body, with its proper Excretory Vessels, which carry away the Gall that lay before in the Mass of the Blood.

Near the Liver lies the *Pancreas*, which *Galen* believed (*q*) to be a Pillow to support the Divisions of the Veins, as they go out of the Liver; and, for what appears at present, the Ancients do not seem to have concerned themselves any further about it. Since, it has been found to be a Glandulous Body, wherein a distinct Juice is separated from the Blood; which, by a peculiar Canal, first discovered by *Georgius Wirtfungus*, a *Paduan* Physician, is carried into the *Duodenum*; where meeting with the Bile, and the Aliment just thrown out of the Stomach, assists and promotes the Business of Digestion.

(q) De U.
P. lib. 5.
cap. 2.

Q

The

The *Spleen* was as little understood as the *Pancreas* ; and for the same Reasons : Its Anatomy was unknown, and its Bulk made it very remarkable ; something therefore was to be said about it : And what no Body could positively dis-prove, might the easier be either received or contradicted. The most general Opinion was, that the grosser Excrements of the Chyle and Blood were carried off from the Liver, by the *Ramus Splenicus*, and lodged in the Spleen, as in a common Cistern : But since the *Circulation of the Blood* has been known, it has been found, that the Blood can go from the Spleen to the Liver, but that nothing can return back again into the Spleen. And as for its Texture, (r) *Malpighius* has discovered, that the Substance of the Spleen, deducting the numerous Blood-Vessels and Nerves, as also the Fibres which arise from its Second Membrane, and which support the other Parts, is made up of innumerable little Cells, like Honey-Combs, in which there are vast Numbers of small Glandules, which resemble Bunches of Grapes ; and that these hang upon the Fibres, and are fed by Twigs of Arteries and Nerves, and send forth the Blood there purged, into the *Ramus Splenicus*, which carries it into the Liver ;

to

(r) De Linc.
ene.

to what purpose, not yet certainly discovered.

The Use of the *Reins* is so very conspicuous, that, from *Hippocrates's* Time, downwards, no Man ever mistook it: But the Mechanism of those wonderful Strainers was wholly unknown, till the so often mentioned *Malpighius* (f) found it out. He therefore, by his Glasses, discovered, that the Kidneys are not one uniform Substance, but consist of several small Globules, which are all like so many several Kidneys, bound about with one common Membrane; and that every Globule has small Twigs from the emulgent Arteries, that carry Blood to it; Glands, in which the Urine is strained from it; Veins, by which the purified Blood is carried off to the Emulgent Veins, thence to go into the *Cava*; a Pipe, to convey the Urine into the great Basin in the middle of the Kidney; and a Nipple, towards which several of those small Pipes tend, and through which the Urine ouzes out of them, into the Basin. This clear Use of the Structure of the Reins, has effectually confuted several Notions that Men had entertained, of some Secondary Uses of those Parts; since hereby it appears, that every Part of the Kidneys is immediately, and wholly

(f) De Re-
nibus.

wholly subservient to that single Use, of Freeing the Blood from its superfluous *Serum*.

What has been done by Modern *Anatomists*, towards the Compleating of the Knowledge of the remaining Parts, I shall omit. That the Ancients likewise took Pains about them, is evident from the Writings of *Hippocrates*, *Aristotle* and *Galen*. The Discoveries which have since been made are so great, that they are, in a manner, undisputed: And the Books which treat of them are so well known, that it will not be suspected that I decline to enlarge upon them, out of a Dread of giving up more to the Ancients in this Particular, than I have done all along.

The Discoveries hitherto mentioned, have been of those Parts or Humours of the Body, whose Existence was well enough known to the Ancients. But, besides them, other Humours, with Vessels to separate, contain, and carry them to several Parts of the Body, have been taken notice of; of which, in strictness, the Ancients cannot be said to have any sort of Knowledge. These are, the *Lympha*, or Colourless Juice, which is carried to the Chyle and Blood, from separate Parts of the Body: And the *Mucilage*

lage of the Joints, which lubricates them, and the Muscles, in their Motions. The Discovery of the *Lympha*, which was made about Forty Years ago, is contended for by several Persons. *Thomas Bartholine*, a Dane, and *Olaus Rudbeck*, a Suede, published their Observations about the same Time: And Dr. *Jolliffe*, an English-Man, shewed the same to several of his Friends, but without publishing any Thing concerning them. The Discoveries being undoubted, and all Three working upon the same Materials, there seems no Reason to deny any of them the Glory of their Inventions. The Thing which they found was, that there are innumerable small, clear Vessels in many Parts of the Body, chiefly in the Lower Belly, which convey a Colourless Juice, either into the common Receptacle of the Chyle, or else into the Veins, there to mix with the Blood. The *Valves* which *Frederic Ruysch* found and demonstrated in them, about the same Time, manifestly shewed, that this is its Road; because they prove, that the *Lympha* can go forwards from the Liver, Spleen, Lungs, Glands of the Loins and Neck, or any other Place, whence they arise, towards some Chyliferous Duct, or Vein; but cannot go back from those Chyliferous

(t) Obser-
vat. Ana-
tom.

(u) Epist.
de Gland.
dul. Conglobat.

(w) Ade-
nograph.

Ducts, or Veins, to the Place of their Origination. What this Origination is, was long uncertain, it not being easie to trace the several Canals up to their several Sources. *Steno* (t) and *Malpighius* (u) did, with infinite Labour, find, that Abundance of Lympheducts passed through those numerous *Conglobate Glands* that are dispersed in the *Abdomen* and *Thorax*; which made them think that the Arterious Blood was there purged of its *Lympha*, that was from thence carried off into its proper Place, by a Vessel of its own. But *Mr. Nuck* has since (w) found, that the Lympheducts arise immediately from Arteries themselves; and that many of them are percolated through those *Conglobate Glands*, in their Way to the Receptacle of the Chyle, or those Veins which receive them. By these, and innumerable other Observations, the Uses of the Glands of the Body have been found out; all agreeing in this one Thing, namely, that they separate the several Juices that are discernable in the Body, from the Mass of the Blood wherein they lay before. From their Texture they have of late been divided into *Conglomerate*, and *Conglobate*. The *Conglomerate Glands* consist of many smaller Glands, which lie near one another, covered

covered with one common Membrane, with one or more common Canals, into which the separated Juice is poured by little Pipes, coming from every smaller Glandule; as in the Liver, the Kidneys, the Pancreas, and Salival Glands of the Mouth. The *Conglobate Glands* are single, often without an Excretory Duct of their own, only perforated by the Lympheducts. Of all which Things, as essential to the Nature of Glands, the Ancient Anatomists had no sort of Notion.

The Mucilage of the Joints and Muscles was found out by Dr. *Havers* (x). He discovered in every Joint, particular Glands, out of which issues a Mucilaginous Substance, whose Nature he examined by numerous Experiments; which, with the Marrow supplied by the Bones, always serves to oil the Wheels, that so our Joints and Muscles might answer those Ends of Motion, for which Nature designed them. This was a very useful Discovery, since it makes Abundance of Things that were very obscure in that Part of Anatomy, very plain, and facile to be understood: And, among other Things, it shews the Use of that excellent Oil which is contained in our Bones, and there separated by proper Strainers,

from the Mass of the Blood; especially, since, by a nice Examination of the true inward Texture of all the Bones and Cartilages of the Body, he shew'd how this Oil is communicated to the Mucilage, and so united as to perform their Office. And if one compares what Dr. *Havers* says of Bones and Cartilages, with what had been said concerning them before him, his Observations about their Frame may well be added to some of the noblest of all the former Discoveries.

These are some of the most remarkable Instances, how far the Knowledge of the Frame of our Bodies has been carried in our Age. Several Observations may be made concerning them, which will be of Use to the present Question. (1.) It is evident, that only the most visible Things were anciently known; such only as might be discovered without great Nicety. Muscles and Bones are easily separable; their Length is soon traced, and their Origination easily known. The same may be truly said of large Blood-Vessels, and Nerves: But when they come to be exquisitely sub-divided, when their Smalness will not suffer the Eye, much less the Hand, to follow them, then the Ancients were constantly at a Loss: For which Reason, they understood

stood none of the *Viscera*, to any tolerable Degree. (2.) One may perceive that every new Discovery strengthens what went before ; otherwise the World would soon have heard of it, and the erroneous Theories of such Pretenders to new Things would have been exploded and forgotten, unless by here and there a curious Man, that pleases himself with reading Obsolete Books. *Nullius in verba* is not only the Motto of the *ROYAL SOCIETY*, but a received Principle among all the Philosophers of the present Age : And therefore, when once any new Discoveries have been examined, and received, we have more Reason to acquiesce in them, than there was formerly. This is evident in the *Circulation of the Blood* : Several Veins and Arteries have been found, at least, more exactly traced, since, than they were in Dr. *Harvey's* Time. Not one of these Discoveries has ever shown a single Instance of any Artery going *to*, or of any Vein coming *from* the Heart. Ligatures have been made of infinite Numbers of Vessels ; and the Course of all the Animal Juices, in all manner of living Creatures, has thereby been made visible to the naked Eye ; and yet not one of these has ever weakened Dr. *Harvey's* Doctrine. The Pleasure

sure of Destroying in Matters of this Kind, is not much less than the Pleasure of Building. And therefore, when we see that those Books which have been written against some of the eminentest of these Discoveries, though but a few Years ago, comparatively speaking, are so far dead, that it is already become a Piece of Learning even to know their Titles, we have sufficient Assurance that these Discoverers, whose Writings outlive Opposition, neither deceive themselves, nor others. So that, whatsoever it might be formerly, yet in this Age general Consent in Physiological Matters, especially after a long Canvass of the Things consented to, is an almost infallible Sign of Truth. (3.) The more Ways are made use of to arrive at any one particular Part of Knowledge, the surer that Knowledge is, when it appears that these different Methods lend Help each to other. If *Malpighius's*, or *Leeuwenhoek's* Glasses had made such Discoveries as Men's Reason could not have agreed to, if Objects had appeared confused and disorderly in their Microscopes, if their Observations had contradicted what the naked Eye reveals, then their Verdict had been little worth. But when the Discoveries made by the Knife and the

the Microscope disagree only as Twi-light and Noon-day, then a Man is satisfied that the Knowledge which each affords to us, differs only in Degree, not in Sort. (4.) It can signifie nothing in the present Controversie, to pretend that Books are lost; or to say, that, for ought we know, *Herophilus* might anciently have made this Discovery, or *Erasistratus* that; their Reasonings demonstrate the Extent of their Knowledge as convincingly as if we had a Thousand old Systems of Ancient Anatomy extant. (5.) In judging of Modern Discoveries, one is nicely to distinguish between *Hypothesis* and *Theory*. The Anatomy of the Nerves holds good, whether the Nerves carry a Nutritious Juice to the several Parts of the Body, or no. The *Pancreas* sends a Juice into the *Duodenum*, which mixes there with the Bile, let the Nature of that Juice be what it will. Yet here a nice Judge may observe, that every Discovery has mended the Hypotheses of the Modern Anatomists; and so it will always do, till the Theories of every Part, and every Juice, be as entire as Experiments and Observations can make them.

As these Discoveries have made the Frame of our own Bodies a much more intelligible Thing than it was before, though

though there is yet a great deal unknown; so the same Discoveries having been applied to, and found in almost all sorts of known Animals, have made the Anatomy of Brutes, Birds, Fishes and Insects much more perfect than it could possibly be in former Ages. Most of the Rules which *Galen* lays down in his *Anatomical Administrations*, are, concerning the Dissection of Apes. If he had been now to write, besides those tedious Advices how to part the Muscles from the Membranes, and to observe their several Insertions and Originations, the Jointings of the Bones, and the like, he would have taught the World how to make Ligatures of all sorts of Vessels, in their proper Places; what Liquors had been most convenient to make Injections with, thereby to discern the Courses of Veins, Arteries, Chyle-Vessels, or Lympheducts; how to unravel the Testicles; how to use Microscopes to the best Advantage: He would have taught his Disciples when and where to look for such and such Vessels or Glands; where Chymical Trials were useful; and what the Processes were, by which he made his Experiments, or found out his Theories: Which Things fill up every Page in the Writings of later Dissectors. This he would have done, as well as
what

what he did, had these Ways of making Anatomical Discoveries been then known and practised. The World might then have expected such Anatomies of Brutes, as Dr. *Tyson* has given of the *Rattle-Snake*; or Dr. *Moulin*, of the *Elephant*: Such Dissections of Fishes as Dr. *Tyson's* of the *Porpess*; and *Steno's*, of the *Shark*: Such of Insects as *Malpighius's* of a *Silk-Worm*; *Swammerdam's*, of the *Ephemeron*; Dr. *Lister's*, of a *Snail*; and the same Dr. *Tyson's*, of *Long and Round Body-Worms*. All which shew Skill and Industry, not conceivable by a Man that is not a little versed in these Matters.

To this Anatomy of Bodies that have Sensitive Life, we ought to add the *Anatomy of Vegetables*, begun and brought to great Perfection in *Italy* and *England* at the same Time, by *Malpighius* and Dr. *Grew*. By their Glasses they have been able to give an Account of the different Textures of all the Parts of Trees, Shrubs and Herbs; to trace the several Vessels which carry Air, Lympha, Milk, Rosin and Turpentine, in those Plants which afford them; to describe the whole Process of Vegetation, from Seed to Seed; and, in a Word, though they have left a great deal to be admired, because it was
to

to them incomprehensible ; yet they have discovered a great deal to be admired, because of its being known by their Means.

CHAP. XX.

Of Ancient and Modern Natural Histories of Elementary Bodies and Minerals.

HAVING now finished my Comparison of *Ancient and Modern Anatomy*, with as much Exactness as my little Insight into these Things would give me Leave, I am sensible that most Men will think that I have been too tedious. But, besides that I had not any where found it carefully done to my Hands, (though it is probable that it has in Books which have escaped my Notice) I thought that it would be a very effectual Instance, how little the Ancients may have been presumed to have perfected any one Part of Natural Knowledge, when their own Bodies, which they carried about with them, and which, of any Thing, they were the nearest concerned to know, were,

were, comparatively speaking, so very imperfectly traced. However, in the remaining Parts of my Parallel, I shall be much shorter; which, I hope, may be some Amends for my too great Length in this.

From those *Instruments*, or *Mechanical Arts*, whether Ancient or Modern, by which *Knowledge* has been advanced, I am now to go to the *Knowledge* it self. According to the Method already proposed, I am to begin with *Natural History* in its usual Acceptation, as it takes in the *Knowledge* of the several Kinds of *Elementary Bodies*, *Minerals*, *Insects*, *Plants*, *Beasts*, *Birds* and *Fishes*. The Usefulness, and the Pleasure of this Part of Learning is too well known to need any Proof. And besides, it is a Study, about which the greatest Men of all Ages have employed themselves. Of the very few lost Books that are mentioned in the *Old Testament*, one was an *History of Plants*, written by the wisest of Men, and he a King. So that there is Reason to believe, that it was cultivated with Abundance of Care by all those who did not place the Perfection of Knowledge in the Art of Wrangling about Questions, which were either useless, or which could not easily be decided.

Before

Before I enter into Particulars, it is necessary to enquire what are the greatest Excellencies of a compleat History of any one sort of Natural Bodies. This may soon be determined. That History of any Body is certainly the best, which, by a full and clear Description, lays down all the Characteristical Marks of the Body then to be described; so as that its Specific Idea may be perfectly formed, and it self certainly and easily distinguished from any other Body, though, at first View, it be never so like it; which enumerates all its known Qualities; which shews whether there are any more besides those already observed; and, last of all, which enquires into the several Ways whereby that Body may be beneficial or hurtful to Man, or any other Body; by giving a particular Account of the several *Phænomena* which appear upon its Application to, or Combination with other Bodies, of like, or unlike Natures. All this is plainly necessary, if a Man would write a full History of any single Species of Animals, Plants, Insects, or Minerals, whatsoever. Or, if he would draw up a General History of any one of these *Universal Sorts*, then he ought to examine wherein every Species of this *Universal Sort* agrees each with other; or wherein they

they are discriminated from any other *Universal Sort* of Things : Thus, by degrees, descend to Particulars, and range every Species, not manifestly Anomalous, under its own Family, or Tribe ; thereby to help the Memory of Learners, and assist the Contemplations of those who, with Satisfaction to themselves and others, would Philosophize upon this amazing Variety of Things.

By this Test the Comparison may be made. I shall begin with the simplest Bodies first ; which, as they are the commonest, so, one would think, should have been long ago examined with the strictest Care. By these I mean, *Air, Water, Earth, Fire* ; commonly called *Elements*. The Three first are certainly distinct and real Bodies, endued with proper and peculiar Qualities ; and so come under the present Question.

Of the *History of Air* the Ancients seemed to know little more than just what might be collected from the Observation of its most obvious Qualities. Its Necessity for the immediate Subsistence of Life, and the unspeakable Force of Rapid Winds, or Air forcibly driven all one Way, made it be sufficiently observed by all the World ; whilst its Internal Texture, and very few of its remoter
R Qualities,

Qualities, were scarce so much as dreamt of by all the Philosophers of Antiquity. Its Weight only was known to *Aristotle* (y), (or the Author of the Book *de Cælo*) who observed, that a full Bladder out-weighed an empty one. Yet this was carried no further by any of the Ancients, that we know of; dis-believed by his own School, who seemed not to have attended to his Word; opposed and ridiculed when again revived, and demonstrably proved, by the Philosophers of the present Age. All which are Evidences, that anciently it was little examined into, since they wanted Proofs to evince that, which Ignorance only made disputable. But this has been spoken to already; I shall therefore only add, that, besides what Mr. Boyle has written concerning the Air, one may consult *Otto Guerick's Magdebourg-Experiments*, the *Experiments of the Academy del Cimento*, *Sturmius's Collegium Curiosum*, Mr. Halley's *Discourses concerning Gravity*, and the *Phænomena of the Baroscope* in the *Philosophical Transactions* (z). From all which one may find, not only how little of the Nature of the Air was anciently known; but also, that there is scarce any one Body, whose Theory is now so near being compleated, as is that of the Air.

The

(y) De
Cælo, l. 4.
c. 4.

(z) Num.
179, &
181.

The *Natural History of Earth and Water* come under that of *Minerals*: *Fire*, as it appears to our Senses, seems to be a Quality, rather than a Substance; and to consist in its own Nature, in a Rapid Agitation of Bodies, put into a quick Motion; and divided by this Motion, into very small Parts. After this had been once asserted by the *Corpuscularian* Philosophers, it was exceedingly strengthened by many Experimental Writers, who have taken abundance of Pains to state the whole *Doctrine of Qualities* clearly, and intelligibly; that so Men might know the difference between the Existence or Essential Nature of a Body, and its being represented to our Senses under such or such an Idea. This is the Natural Consequence of proceeding upon clear and intelligible Principles; and resolving to admit nothing as conclusive, which cannot be manifestly conceived, and evidently distinguished from every Thing else. Here, if in any Thing, the old Philosophers were egregiously defective: What has been done since, will appear by consulting, among others, the Discourses which Mr. Boyle has written upon most of the considerable Qualities of Bodies, which come under our Notice; such as his *Histories of Fluidity and*

Firmness, of Colours, of Cold, his Origin of Forms and Qualities, Experiments about the Mechanical Production of divers particular Qualities, and several others, which come under this Head; because they are not Notions framed only in a Closet, by the help of a lively Fancy; but Genuine Histories of the Phenomena of Natural Bodies; which appeared in vast Numbers, after such Trials were made upon them, as were proper to discover their several Natures.

And therefore, that it may not be thought that I mistake every plausible Notion of a witty Philosopher for a new Discovery of Nature, I must desire that my former Distinction between *Hypotheses* and *Theories* may be remembred. I do not here reckon the several *Hypotheses* of *Des Cartes*, *Gassendi*, or *Hobbes*, as Acquisitions to real Knowledge, since they may only be Chimæra's and amusing Notions, fit to entertain working Heads. I only alledge such Doctrines as are raised upon faithful Experiments, and nice Observations; and such Consequences as are the immediate Results of, and manifest Corollaries drawn from, these Experiments and Observations: Which is what is commonly meant by *Theories*. But of this more hereafter.

That

That the *Natural History of Minerals* was anciently very imperfect, is evident from what has been said of *Chymistry* already ; to which, all the Advances that have ever been made in that Art, unless when Experiments have been tried upon *Vegetable* or *Animal Substances*, are properly to be referred. I take *Minerals* here in the largest Sence ; for all sorts of *Earths*, *Sulphurs*, *Salts*, *Stones*, *Metals*, and *Minerals* properly so called. For *Chymistry* is not only circumstantially useful, but essentially necessary here ; since a great many Minerals of very differing Natures would never have been known to have belonged to several Families, if they had not been examined in the Furnaces of the Chymists. But I think this is so clear, that I should lose Time if I should say any Thing more about it ; and therefore I shall rather mention some other Things, wherein Discoveries have been made in and by Mineral Bodies, without the help of *Chymistry*. The greatest of which is, of a Stone which the Ancients admired (a), without ever examining to what Uses it might be applied ; and that is, *the Magnet* : The noblest Properties whereof Sir *William Temple* acknow-

(a) *Their Opinions are collected by Gassendi, in his Animadversions upon Laërtius's Life of Epicurus, p. 362, 363.*

(b) Pag.
48.

ledges to be anciently unknown (b); which is more, indeed, than what some

(c) *This they have collected from a Passage in Plautus, Merc. Act. 5. Sc. 2. Huc Secundus Ventus nunc est, cape modo vorforiam; where by vorforia they understand the Compass, because the Needle always points towards the North: Whereas vorforia is nothing but that Rope with which the Mariners turned their Sails.*

do (c), who, at the same Time, make our Fore-fathers to have been extreamly stupid, that could suffer such a Discovery to be ever lost. So that all that can be said of the Advances which, by the Uses of the *Load-stone*, have been made in several Parts of Learning, do not in the least affect *Sir William Temple*. However, I shall mention some of the

greatest, because he charges the Moderns with not making all the Uses of so noble an Invention; which he supposes the Ancient *Greeks* and *Romans* would have made, had it fallen into their Hands: Which makes him assert, that the Discoveries hereby made in remote Countries have been rather pursued to accumulate Wealth (d), than to increase Knowledge. Now, if both these can be done at once, there is no Harm done: And since there is no Dispute of the one, I think it will be an easie Matter to prove the other. I shall name but a few Particulars, most of them rather belonging to another Head.

(n) Pag.
49.

Geography therefore was anciently a very imperfect Study, for want of this Knowledge

Knowledge of the Properties of the *Loadstone*. The Figure of the Earth could formerly only be gueſſed at; which Sir *William Temple's* admired *Epicurus* (e) did, for that Reason, deny to be round; wherein he ſeems to have been more reaſonable, than in many other of his Aſſertions; becauſe he thought it an Affront to the Underſtanding of Man, to be determined by bare Conjectures, in a Matter which could no other Way be decided. Whereas now, moſt Parts of the Ocean being made eaſily acceſſible, the Latitudes, and reſpective Bearings of every Place are commonly known: The Nature and Appearances of Winds and Tides are become familiar, and have been nicely examined by Intelligent Men in all Parts of the World: The Influence of the Moon, joyned with the Motion of the Earth, have been taken in upon almoſt infallible Grounds, to found Theories of the Sea's Motion upon. And there are great Numbers of other noble, pleaſant and uſeful Propoſitions in *Geography, Astronomy* and *Navigation*, which ultimately owe their Original to the Diſcovery of that ſingle Quality of this wonderful Stone, *that it always points towards the North*. If theſe Sciences have brought to us the Wealth of the *Indies*, if they

(e) Vide
Gaſſendi's
Animad-
verſions
upon Laër-
tius's *Epi-
curus*, pag.
672.

have enlarged the Commerce and Inter-
course of Mankind, it is so far from be-
ing a Disparagement to the Industry of
the Moderns, who have cultivated them
to such useful Purposes, that it is the
highest Character that could be given of
those Men, that they pursued their In-
ventions to such noble Ends. Knowledge
not reduced to Practice, when that is
possible, is so far imperfect, that it loses
its principal Use. And it is not for ac-
quiring Wealth, but for mis-employing
it when he has acquired it, that a Man
ought to be blamed.

Now, to compleat what I have to say
of *Geography* all at once, I shall take no-
tice, that as the Improvements by Navi-
gation have made all the Sea-Coasts of
the Universe accessible, so the Art of En-
graving upon Copper-Plates has made it
easie for Men to draw such Draughts of
every particular Coast, as will imprint
lasting and just Idea's of all the Parts of
the known World. For want of this,
the Ancient Descriptions even of those
Countries which they knew, were rude,
and imperfect: Their Maps were neither
exact, nor beautiful: The Longitudes
and Latitudes of Places, were very little,
if at all, considered; the latter of which
can now be exactly determined, and the
former

former may be very nearly adjusted, since the Application of Telescopes to Astronomical Uses has enabled Men to make much nicer Observations of the Moon's Eclipses than could formerly be made; besides those of *Jupiter's* Satellites, to which the Ancients were entirely Strangers. This makes our Maps wonderfully exact; which are not only the Diversions of the Curious, but of unspeakable Use in Civil Life, at Sea especially; where, by the help of Sea-Charts, Sailors know where they are, what Rocks lie near them, what Sands they must avoid; and can as perfectly tell which Way they must steer to any Port of the Universe, as a Traveller can, upon *Salisbury-Plain*, or *New-Market-Heath*, which Way he must ride to a great Town, which he knows before-hand is not far from the Edge of the Plain, or of the Heath. *Velferus* has printed some ancient Maps (f), that were made for the Direction of the *Roman* Quarter-Masters; and if a Man will compare them with *Sanfon's*, or *Blau's*, he will see the difference; which in future Ages will certainly be vastly greater, if those Countries which are now barbarous, or undiscovered, should ever come into the Hands of a Civilized or Learned People. But I have not yet done with the *Load-stone*. Besides

(f) Commonly called the Peutingarian Tables.

Besides these occasional Uses of the *Magnet*, its Nature, abstractedly taken, has been nicely enquired into, thereby to discover both its own Qualities, and its Relation to other Bodies that are round about it. And here indeed one may justly wonder,

(g) To him this Discovery is attributed by Sal-muth upon Pancirollus; others call him John Goia of Amalphi; but Gassendi, Animad. Pag. 364. says, it was found out by a French-man, about the Year MCC. since it is mentioned by one Guyotus Provineus, a French Poet of that Time, who calls the Compass *Marineta*; to which Gassendi also adds, That it was most probably a French Invention, because the North-Point is by all Nations marked in their Compasses by a Flower-de-Luce, the Arms of France.

that when *Flavio Amalphi* (g) had discovered that Iron touched with a *Magnet*, always points towards the North, that all the Philosophers of that Age did not immediately try all Manner of Experiments upon that strange Stone, which was found to be so exceedingly useful in Matters of common Life: The *Portuguezes*, who first made daring Voyages by the Help of the Compass into the Southern and South-Eastern Seas, better knew the Value of that rich Discovery; but Philosophy

was in those darker Ages divided between the School-men and the Chymists; the former presently salved the Business with their *Substantial Forms*, and what they could not comprehend came very properly under the Notion of an *Occult Quality*: The latter found nothing extraordinary in their Crucibles when they analyzed

analyzed the *Magnet* ; and so they seem soon to have given it over : Besides, in those Days few Men studied Chymistry with any other Design than that of finding out the Philosopher's Stone, to which the Load-stone could do them no further Service than that of supplying them with another hard Name to cant with (*h*). For these Reasons therefore, it lay in a good Measure neglected by Men of Letters, till our famous Countryman Dr. *Gilbert* of *Colchester*, by a vast Number of Experiments, found that *the Earth* was but a larger *Magnet*, and he indeed, was the first Author of all these magnetical Speculations which have been made since that have had the good Fortune to be generally approved. This great Man, whom *Galileo* and *Kepler* express a great Veneration for in their Writings, deserves here to be mentioned upon another Account, because He, my Lord *Bacon*, and Mr. *Harriot*, all *English-men*, are the Three Men to whom Monsieur *Des Cartes* was so very much obliged for the first Hints of the greatest things, which he has given us in his Philosophical and Mathematical Discourses. For nothing does more convincingly put these things out of Doubt, than to trace them up to their first Originals, which can be done

(h) *Magnesia Nigra*, used by *Eyrenæus Philalthes*, and ridiculed by *Surly* in *Ben Johnson's Alchemist*.

done but in a very few. But it is time to proceed.

CHAP. XXI.

Of Ancient and Modern Histories of Plants.

THE *Natural History of Plants* comes next; which, for Variety and Use, is one of the noblest and pleasantest Parts of Knowledge. Its Mechanical and Medicinal Advantages were early known. Fruits afforded the first Sustenance to Mankind; and the old Heathens esteemed those worthy of Consecration, who taught them to till their Grounds, gather their Seed, and grind their Corn; with Trees they built themselves Houses, afterwards they found that the Bark of some Plants would serve for Cloaths, and others afforded Medicines against Wounds and Diseases. There is no doubt therefore, but this Part of Knowledge was sufficiently cultivated for the Uses of humane Life; especially when the World becoming Populous, had communicated their Notions together, and Conversation had introduced the Arts of
Luxury

Luxury and Plenty amongst Mankind. But whether the *Natural History of Plants* was so exactly known formerly as it is at present, is the Question.

The ancientest Writers of *Plants* now extant, are *Theophrastus*, *Pliny* and *Dioscorides*; indeed the only ones who say any thing considerable to the present Purpose. *Theophrastus* describes nothing; gives abundance of Observations of several Plants, and the like; but what he says is too general for our Purpose. *Pliny* and *Dioscorides* who lived long after him do give Descriptions indeed of a great many Plants, but short, imperfect and without Method; they will tell you for Instance, that a Plant is hairy, has broad Leaves, that its Stalks are knotty, hollow or square; that its Branches creep upon the Ground, are erect, and so forth; in short, if there is any thing remarkable in the Colour or Shape of the Stalk, Root, Seed, Flower or Fruit, which strikes the Eye at first Sight, it may perhaps be taken Notice of, but then every thing is confused, and seldom above one or two Plants of a sort are mentioned; though perhaps later *Botanists* have observed some Scores plainly reducible to the same general Head. *Pliny* ranges many of the Plants, which he describes in an Order (i)

(i) N. H. Order (i) something Alphabetical, o-
 l. 12. cap. thers (k) he digests according to their
 13. and l. 27. Virtues, others he (l) puts together, be-
 throughout. cause they were discovered by great Per-
 (k) The sons, and called by their Discoverers
 12th. Book Names; all which Methods, how much
 is chiefly of soever they may assist the Memory in re-
 Trees which membring hard Names, or in retaining
 bear odori- the *Materia Medica* in one View in a
 ferous Man's Head, signifie nothing to the Un-
 Gums, and derstanding the Characteristical Differen-
 so on of all ces of the several Plants; by which alone,
 the rest. and not by accidental Agreements in Vir-
 (l) N. H. tue, Smell, Colour, Taft, Place of Growth,
 l. 25. cap. Time of sprouting, or any mechanical
 6, 7. & a- Use to which they may be made service-
 libi passim. able, Men may become exact *Botanists*:
 Without such a Method, to which the
 Ancients were altogether Strangers, the
 Knowledge of Plants is a confused thing
 depending wholly upon an uncommon
 Strength of Memory and Imagination,
 and even with the Help of the best Books
 scarce attainable without a Master.

Conradus Gesner, to whose Labours
 the World has been unspeakably behol-
 den in almost all Parts of Natural Histo-
 ry, was the first Man (that I know of)
 who hinted at the true Way to distinguish
 Plants, and reduce them to fixed and cer-
 tain Heads. In a Letter to *Theodorus*
Zuingerus

Zuingerus (m), he says, that Plants are to be ranged according to the Shape of their Flowers, Fruits and Seeds; having observed that Cultivation, or any accidental Difference of Soil, never alters the Shape of these more Essential Parts; but that every Plant has something there peculiar, by which it may be distinguished, not only from others of a remoter *Genus*, but also from those of the same Family.

About the same Time *Andreas Casalpini*, and *Fabius Columna*, the first especially, reduced that into an Art, which *Gesner* had hinted at before; yet what they writ lay neglected, though *Clusius*, *Caspar Bauhinus*, *Parkinson*, *Gerard* and *Johnson*, and *John Bauhinus* had taken very laudable Pains in describing, not only the more general Sorts taken notice of by the Ancients, but also in observing their several Sub-divisions with great Niceness and Skill. *John Bauhinus* also had described every particular Plant then known, in his *General History of Plants*, with great Accuracy; and compared whatsoever had been said before, and adjusted old Names to those Plants which Modern Herbarists had gathered, with so much Care, that the Philological Part of *Botany* seems by him to have,

(m)Epist.
Medicinal.
p.113. a.

have, in a manner, received its utmost Perfection.

The great Work already begun by *Cassalpinus* and *Columna*, was still imperfect; which, though, perhaps, not the most laborious, was yet the most necessary to a Man that would consider those Things Philosophically, and comprehend the whole Vegetable Kingdom, as the Chymists call it, under one View. This was, to digest every Species of Plants under such and such Families and Tribes; that so, by the help of a general Method, taken only from the Plants themselves, and not from any accidental Respects, under which they may be considered, once thoroughly understood, a Learner might not be at a Loss upon the Sight of every new Plant that he meets with, but might discern its General Head at first View; and then, by running over the Tables thereunto belonging, might, at last, either come to the particular Species which he sought for, or, which would do as well, find that the Plant before him was hitherto undescribed, and that by it there would be a new accession made to the old Stock. Mr. Ray drew a rough Draught of this Matter, in the *Tables of Plants* inserted into Bishop Wilkins's Book, of a *Real Character*, and *Philosophical*

phical Language ; and was soon followed by Dr. Morison, in his *Hortus Regius Ble-sensis* ; who, pursuant to his own Method, begun a *General History of Plants* ; which he not living to finish, Mr. Ray undertook the whole Work anew, and very happily compleated it.

This great Performance of his, which will be a standing Monument of Modern Industry and Exactness, deserves to be more particularly described. First, therefore, He gives an Anatomical Account, from *Malpighius* and *Grew*, of Plants in general : And because the Ancients had said nothing upon that Subject, of which, for want of Microscopes, they could only have a very obscure Notion, all that he says upon that Head is Modern. Afterwards, when he comes to particular Plants, he draws up Tables, to which he reduces the whole Vegetable Kingdom, except a very few irregular Plants, which stand by themselves. These Tables are taken from the Shape of the Flowers, Seeds, Seed-vessels, Stalks and Leaves ; from the Number or Order of these when determined, and Irregularity when undetermined ; from the Want, or having of particular Juices, Lympha's, Milks, Oils, Rosins, or the like : In short, from Differences, or Agreements, wholly arising

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sing from the Plants themselves. His Descriptions are exacter than *John Bauhine's* ; and his are much better than those of the Generality of Botanists that were before him ; and there are scarce any of theirs, which are not preferable to those of *Pliny*, and *Dioscorides*. He avoids Confusion of Synonymas, which had made former Authors tedious ; and by inserting what was already extant in the *Mala-bar Garden*, *Boym's Flora Sinensis*, *Marc-gravius's Natural History of Brasil*, *Hernandez's Account of the Plants of Mexico*, *Cornutus's History of the Plants of Canada*, and other *Indian Accounts of Natural Rareties*, into his General History, has shewed, that the Moderns have been as careful to compleat the Natural History of remoter Countries, as to understand the Productions of their own.

It may be wonder'd at, perhaps, why I should mention this, since the Ancients were not to be blamed for being ignorant of Things which they had no Opportunities of knowing. But, besides that it proves the Extent of Modern Knowledge in Natural History, which may be considered, without any Regard to the Opportunities of acquiring it, it proves also, against *Sir William Temple*, that the Moderns have done what they could in every Point,

Point, to make the greatest Use they were able of every Addition to their former Knowledge, which might accrue to them by the Discovery of the Usefulness of the *Load-Stone* in Navigation. His Words are these ; (n) *The vast Continents* (n) Pag. 49. of China, the East and West-Indies, the long Extent and Coasts of Africa, have been hereby introduced into our Acquaintance, and our Maps ; and great Increases of Wealth and Luxury, but none of Knowledge brought among us, further than the Extent and Situation of Country, the Customs and Manners of so many Original Nations.— I do not doubt but many great and more noble Uses would have been made of such Conquests, or Discoveries, if they had fallen to the Share of the Greeks and Romans, in those Ages, when Knowledge and Fame were in as great Request as endless Gains and Wealth are among us now : And how much greater Discoveries might have been made by such Spirits as theirs, is hard to guess. Sir William Temple here owns, that the Political Uses which can be made by such Discoveries, are inconsiderable ; though, at the same Time, he confesses, that even those have not been neglected, since he acknowledges that Men have brought from those Barbarous Nations their Customs and Manners ;

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which is the only Political Use that I know of that is to be learnt by Travel. What other Advantages might have been made, is hard to tell, unless such as may conduce to the Compleating of Natural History; the Benefits whereof are agreed upon of all Hands to be very great. The Subject now before me is *Botanics*, which has been so far from being neglected, that all imaginable Care has been taken to compleat it. Monsieur *Van Rheed*, the noble Collector of the Plants that are so magnificently printed in the Eleven Volumes of the *Hortus Malabaricus*, has added more to the Number of those formerly known, than are to be found in all the Writings of the Ancients. When

(o) Ment-
zel. Index
Plantar.
Multiling.
in Prefa-
tione.

(o) Prince *Maurice* of *Nassaw*, who gave Sir *William Temple* the wonderful Account of the Parrot which he mentions in his *Memoirs*, was in *Brasil*, he ordered Pictures and Descriptions to be taken of all the Beasts, Birds, Fishes and Plants that could be found in that Country: They are now in the Elector of *Brandenburgh's* Library, fit for the Press. Every Day new Additions are made to this Part of Natural History. *Breynius's*, *Plukenet's*, and *Herman's* Collections, are Modern to those of *Clusius*, *Rauwolfius*, and *Prosper Alpinus*; as theirs are to those of *Pliny*,

Pliny, and *Dioscorides*. One is also to consider, that this is a much more laborious Business, than the Knowledge of Fowls, Fishes, and Quadrupeds. The Confusion in which the Ancients left *Botanical Knowledge*, shews how little they understood it. And, which is still more remarkable, it is not only in *Indian* or *Chinese* Rareties, that our *Botanical Knowledge* excels theirs; but in the Productions of Countries, equally accessible to them, as to us. There are no new Species in *Europe* or *Asia*, which the Ancient Herbarists could not have discovered; no new Soils to produce them without Seed, in case such a Thing were ever naturally possible. Let but a Man compare Mr. *Ray's Catalogue of English Plants*, and those other numerous Catalogues of the Plants of other Countries, drawn up by other Modern Botanists, with the Writings of *Pliny* and *Dioscorides*; let him run over *Ray's General History*, or, if that be not at hand, *Gerard's*, *Parkinson's*, or *John Bauhine's Herbals*, or *Gaspard Bauhine's Pinax*; and deduct every Plant, not growing wild, within the Limits of the *Roman Empire*, and he will see enough to convince him, that not only this Part of Knowledge is incomparably more exact and large than it was for-

merly ; but also, by comparing the Writings of the first Restorers of the Knowledge of Simples, *Matthiolus*, *Dodonaus*, *Fuchsius*, *Turner*, and the rest, with the Writings of *Ray* and *Morison*, that it has been always growing, and will do so still, till the Subject is exhausted.

It is well known that Travelling in *Mahometan* Countries is very dangerous ; that it is what no Man that makes Learning his Aim in Journeying, would willingly undertake, if he were not very ardently possessed with the Love of it. So that whatsoever Perils the *Ancient Sages* endured in their Journeys into *Egypt* for Knowledge, are equalled at least, if not out-done, by our *Modern Sages* ; to use that Word, in Sir *William Temple's* Sence, for one that goes far and near to seek for Knowledge. Nay, I may safely add, that a few inquisitive and learned Travellers, such as *Rauwolfius*, *Prosper Alpinus*, *Bellonius*, *Guilandinus*, and Sir *George Wheeler*, have acquainted the learned Men of these Parts of the World with the Natural History of the Countries of the *Levant*, not only better than they could have known it by reading the Books of the Ancients ; but, in many Particulars, better than the Ancients themselves, Natives of those very Countries, knew it, if the

the extant Books can enable us to give a competent Judgment in this Matter. And if Travelling far for Knowledge be sufficient to recommend the Ancients to our Imitation, I may observe, that Mr. *Edmond Halley*, who went to *St. Helena*, an Island situate in the 16th Degree of Southern Latitude, to take an Account of the Fixed Stars in the Southern Hemisphere, which are never visible to us who live in the Northern; and to *Dantzick*, to conferr about Astronomical Matters, with the great *Hevelius*, has taken much larger Journeys than any of the Ancients ever did in the sole Pursuit of knowledge. So much for the *Natural History of Bodies not endued with Sensitive Life*.

C H A P. XXII.

Of Ancient and Modern Histories of Animals.

I*Nsects* seem to be the lowest and simplest Order of Animals; for which Reason I shall begin with them. That some are very beneficial to Man, affording him Food and Rayment; as, the *Bee*, and the *Silk-Worm*: And others, again,

(p) N.H.
l.ii. c.9.

very troublesome; as, *Wasps*, *Hornets*, *Gnats*, *Moths*, and abundance more; was formerly as well known as now. In their Observations about *Bees*, the Ancients were very curious. *Pliny* (p) mentions one *Aristomachus*, who spent Fifty Eight Years in observing them: And it is very evident from him, *Aristotle*, and *Ælian*, that, as far as they could make their Observations, the Ancients did not neglect to digest necessary Materials for the Natural History of this wonderful and useful Insect. They were so particularly careful to collect what they could gather concerning it, that it is to be feared a very great Part of what they say is fabulous.

But if they were curious to collect Materials for the History of this single Insect, they were, in the main, as negligent about the rest. They had, indeed, Names for general Sorts of most of them; and they took notice of some, though but few, remarkable Sub-divisions. The Extent of their Knowledge in this Particular has been nicely shewn by *Aldrovandus* and *Moufet*. In their Writings one may see, that the Ancients knew nothing of many Sorts; and of those which they mention, they give very indifferent Descriptions; contenting themselves with such

such Accounts as might, perhaps, refresh the Memories of those who knew them before, but which could signifie very little to those who had never seen them. But of their Generation or Anatomy they could know nothing considerable, since those Things are, in a great Measure, owing to Observations made by Microscopes; and having observed few Sub-divisions, they could say little to the Ranging of those Insects which they knew already by distinct Characteristicks, under several Heads. For want of observing the several Steps of Nature in all their Mutations, and taking notice of the Sagacity of many sorts of Insects, in providing convenient Lodgings for themselves, and fit Harbours for their young ones, both for Shelter and Food, they often took those to be different, which were only the same Species at different Seasons; and those to be near of Kin, which only Chance, not an Identity of Nature, brought together.

The Clearing of all these Things is owing to Modern Industry, since the Time that Sir *William Temple* has set as a Period of the Advancement of Modern Knowledge; even within these last Forty Years. It lies, for the most part, in a very few Hands; and so is the more easily

(q) Expe-
rimenta
circa Gene-
rationem
Insectorum.

fily traced. In *Italy*, *Malpighius* and *Rhedi* took several Parts. *Rhedi* (q) examined very many general Sorts, those Insects especially which are believed to be produced from the Putrefaction of Flesh: Those he found to grow from Eggs laid by other grown Insects of the same Kinds. But he could not trace the Origination of those which are found upon Leaves, Branches, Flowers, and Roots of Trees. The Generation of those was nicely examined by *Malpighius*, in his curious Discourse of *Galls*, which is in the 2d. Part of his *Anatomy of Plants*; wherein he has sufficiently shewn, that those Excrescencies and Swellings which appear in Summer upon the Leaves, tender Twigs, Fruits and Roots of many Trees, Shrubs and Herbs, from whence several sorts of Insects spring, are all caused by Eggs laid there by full grown Insects of their own Kinds; for which Nature has kindly provided that secure Harbour, till they are able to come forth, and take Care of themselves. But *Rhedi* has gone further yet, and has made many Observations upon Insects that live, and are carried about on the Bodies of other Insects. His Observations have not been weakned by Monsieur *Leeuwenhoek*, whose Glasses, which are said to excel any ever yet used by

by other People, shewed him the same Animals that Monsieur *Rhedi* had discovered already ; and innumerable sorts of others, never yet thought of.

Besides Monsieur *Leeuwenhoek*, there have been two very eminent Men in *Holland* for this Business ; *Goedartius* and *Swammerdam*. *Goedartius*, who was no Philosopher, but one who, for his Diversion, took great Delight in painting all sorts of Insects, has given very exact Histories of the several Changes of Caterpillars into Butter-Flies, and Worms or Maggots into Flies ; which had never before been taken notice of, as specifically different. These Changes had long before been observed in Caterpillars and Maggots by *Aristotle*, *Theophrastus* and *Pliny* : But they, who did, in a manner, all that has been done in this Matter by the Ancients, content themselves with general Things. They enter not into Minute Enquiries about the several Species of these Animals, which are very numerous : They do not state the Times of their several Changes. So that these Matters being left untouched, we have an admirable Specimen of the Modern Advancement of Knowledge, in *Goedartius's* Papers (r).

(r) De In-
sectis. Edit.
Lifter.

Still

(f) Me-
tam. l. 15.

(t) Hist.
General.
Insect.

Still an Anatomical Solution of these Appearances was wholly unknown. What (f) *Ovid* says of the Metamorphoses of Insects, is suitable enough to the Design of his Poem: And there we may well allow such a Natural Change of Caterpillars into Butter-Flies, as is not to be accounted for by the Regular Laws of Growth and Augmentation of Natural Bodies. But a Natural Historian has no need of the Fictions of a Poet. These Difficulties therefore were cleared by *Swammerdam* (t), who, in his *General History of Insects*, proves, that all the Parts of the full-grown Insect, which first appears in a different Form from what it assumes afterwards, were actually existent in the *Fætus*, which creeps about as a Caterpillar, or a Maggot, till the Wings, Horns and Feet, which are inclosed in fine Membranes, come to their full Growth; at which Time that Membrane, which at first was only visible, dries up, and breaks; out of which comes forth the Insect proper to that Kind; which then gendring with its like, lays such Eggs as in a seasonable Time are hatched; that so the Species, which is not generated by Chance, may always be preserved.

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In *England*, Dr. *Lister* has done the most to compleat this Part of Natural History. His *Book of Spiders* gives an Account of very many Species of those Animals, formerly unobserved. His *Latin and English Editions of Goedartius*, have not only made that Author more intelligible, by ranging his confused Observations under certain Heads conformable to Nature, which may serve also as Foundations to enlarge upon, as more Species shall hereafter be discovered; but also have given him an Opportunity of saying many new Things, pertinent to that Subject, all tending to increase our Knowledge of those small Productions of the Divine Mechanicks. And his *Discourse of Snails*, lately printed, has shewn several very curious Things in that wonderful Tribe of Animals; which, though observed above Thirty Years ago, by Mr. *Ray*, yet had not been much believed, because not sufficiently illustrated by some able Anatomist.

This is what our Age has seen; and it is not the less admirable, because it cannot be made immediately useful to humane Life: It is an excellent Argument to prove, That it is not Gain alone which biasses the Pursuits of the Men of this Age after Knowledge; for here are
numerous

numerous Instances of Learned Men, who finding other Parts of Natural Learning taken up by Men, who in all Probability would leave little for After-comers, have, rather than not contribute their Proportion towards the Advancement of Knowledge, spent a World of Time, Pains and Cost, in examining the Excrescencies of all the Parts of Trees, Shrubs, and Herbs, in observing the critical Times of the Changes of all sorts of Caterpillars and Maggots, in finding out by the Knife and Microscopes the minuteſt parts of the ſmalleſt Animals, in examining every Crevice, and poring in every Ditch, in tracing every Inſect up to its Original Egg, and all this with as great Diligence, as if they had had an *Alexander* to have given them as many Talents, as he is ſaid to have given to his Maſter *Ariſtotle*.

I ſhall put *Fiſhes*, *Fowls* and *Quadrupeds* together, becauſe the Queſtion as it relates to the Natural Hiſtory of theſe Animals, may be brought into a ſmall Compaſs. For as to the Anatomical part it is certain, That every Inſtance of the Defect of Ancient Anatomy already mentioned, is a Proof how little the Texture of the inward Parts of all theſe Creatures could poſſibly be known, and conſequent-
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ly that no Old Descriptions of these Animals which should go beyond the parts immediately visible would have been considerable. There is hardly one eminent Modern Discovery in Anatomy, which was not first found in Brutes, and afterwards adjusted to humane Bodies. Many of them could never have been known without the Help of Live-dissections; and the rest required Abundance of Trials upon great Numbers of different sorts of Beasts, some appearing plainer in one sort of Animals, and some in another, before the Discoverers themselves could frame such a clear Idea of the things which they were then in Pursuit of, as that they could readily look for them in Humane Bodies; which could not be procured in so great Plenty, and of which they had not always the Convenience. All which things extremely tended to the perfecting of the Anatomy of all sorts of Brutes. About the other Part, which may comprehend an Account of their Way of Living, their Uses to humane Life, their Sagacity, and the like; the Ancients took much Pains, and went very far: And there are a great many admirable things in *Aristotle's History of Animals* concerning all these Matters. What Helps he had from Writers that lived before him

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we know not; if he had but little, it must be owned that his Book is one of the greatest Instances of Industry and Sagacity that perhaps has ever been given. But since, the Question is not so much, whether that is an excellent Book, as whether it is perfect, it ought to be compared with Mr. *Willoughby's Histories of Fishes and Birds*, and Mr. *Ray's Synopsis of Quadrupeds*, as the perfectest Modern Books upon these Matters; and then it will be easie to make a Judgment. I shall not make it my self, because no Man can mistake, that compares them, though never so negligently, together. I name only *Aristotle*, because he is, to us at least, an original Author: He had examined very many things himself, and though he took a great deal upon trust, yet that could not be avoided, since he had so little, that we know of, from more remote Antiquity, and it was too vast a Work for any one single Man to go through with by himself. *Ælian* and *Pliny* seem only to have copied, and, with Submission be it spoken, their Writings are *Rhapsodies* of Stories and Relations partly true, and partly fabulous, which themselves had not Skill enough to separate one from the other, rather than *Natural Histories*; from which Accusation, even *Aristotle* himself

himself cannot wholly be excused. To make this Comparison the easier, one may consult *Gesner* and *Aldrovandus*; or, if they are too voluminous, *Wotton De Differentiis Animalium*, who has put under one View, in several Heads, almost every thing that is to be found in any ancient Authors concerning these things. What he has collected of the Elephant, may be compared with *Dr. Moulin's* Anatomy of the same Creature: The Ancients Observation concerning Vipers may be read along with *Rhedi's* and *Charas's*. Their Anatomical Descriptions of many other Animals may be examined with those published by the Members of the *French Academy* and *Mr. Ray* in his *Synopsis*: And then the Imperfections of the one, and the Excellencies of the other will be clearly seen, and the Distance between each exactly stated; though perhaps this may seem too far about, since it is manifest at first Sight, That no ancient Descriptions of any Creatures could be at present valuable, when their whole Anatomy was so imperfect. Some mistakes however might, methinks, have been prevented; the *Egyptian Sages* could sure have taught them that a Crocodile moves his under-Jaw and not his upper; they might soon have found that a Lion has

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Vertebres in his Neck, and with them by Consequence can move it upon Occasion; and has as large a Heart as other Crea-

tures of his Size; that a (u) *Porcupine* shoots out none of his Quills upon those that set upon him; and several other things, which would have prevented several Over-sights that are not much for the Honour of *Ancient Diligence*. This would have saved Abundance of fabulous Relations that may be found in ancient Naturalists. Their heaping up monstrous Stories without giving distinguishing Marks many times to testify which they believed, and which not, is an evident Sign, that they were not enough acquainted with these Creatures to make a tho-

rough Judgment what might be relied upon, and what ought to be rejected. For accurate Skill in these things helps a Man to judge as certainly of those Relations which himself never saw, as Political Skill does to judge of Accounts of Matters that belong to civil Life, and a great deal better, by how much Nature goes in an even Course than the

(u) Borellus de Motu Animalium Part. II. Prop. 219. *Fabulosa narratio passim circumfertur de Hystrice, quæ cutem tendendo, spinas illas prælongas quibus dorsum ejus tegitur, longius ejaculatur. De hoc Animali enarrabo ea, quæ propriis oculis vidi. Hystrix non ejaculatur spinas suas prælongas, sed tantummodo eas arrectas retinendo tremulâ concussione agitât & vibrat. Hoc quidem efficitur à pelle musculosâ, & à musculis semilunaribus, quibus interna cutis stipata est, qui radices spinarum erigunt & concutunt. Vide quoque Raii Synopsis Animal. Quadruped. Pag. 209.*

the Wills and Fancies of Men, which are the Foundations of most of the Things that are transacted in the World.

CHAP. XXIII.

*Of Ancient and Modern Astronomy,
and Opticks.*

HAVING now gone through with the several Parts of *Natural History*, I am to enquire into the State of *Physico-Mathematical* and *Physical* Sciences: Such as *Astronomy*, *Opticks*, *Musick* and *Medicks*. I put *Astronomy* first, because of the vast Extent, and real Nobleness of its Subject; and also because it has suffered the least Eclipse of any part of Knowledge whatsoever in the barbarous Times: For when the *Greeks* neglected it, the *Arabs*, and from them the *Spaniards* took it up. That this Enquiry might be the more exactly made, and that you might be thoroughly convinced of the Truth in this Matter, to which chiefly our Obligation lies, Mr. *Edmond Halley*, whose Labours towards the Advancement of this Science, have made him famous in so many distant Parts of the World, did me

the Favour to communicate this following Paper.

‘ As for the Astronomy of the Ancients, this is usually reckoned for one of those Sciences wherein consisted the Learning of the *Egyptians*; and *Strabo* expressly declares, That there were in *Babylonia* several Universities, wherein Astronomy was chiefly professed; and *Pliny* tells us much the same thing: So that it might well be expected, that where such a Science was so much studied, it ought to have been proportionably cultivated. Notwithstanding all which it does appear, That there was nothing done by the *Chaldeans* older than about CCCC Years before *Alexander’s* Conquest, that could be serviceable either to *Hipparchus*, or *Ptolemee* in their Determination of the celestial Motions: For had there been any Observations older than those we have, it cannot be doubted but the victorious *Greeks* must have procured them, as well as those they did, they being still more valuable for their Antiquity. All we have of them is only Seven Eclipses of the Moon, preserved in *Ptolemee’s Syntaxis*; and even those, but very cursorily set down, and the oldest not much above 700 Years before Christ, so that
‘ after

‘ after all the Fame of these *Chaldeans*,
 ‘ we may be sure they had not gone far
 ‘ in this Science ; and though *Callisthenes*
 ‘ be said by *Porphyry* to have brought
 ‘ from *Babylon* to *Greece*, Observations
 ‘ above M DCCCC Years older than *A-*
 ‘ *lexander*, yet the proper Authors ma-
 ‘ king no Mention, or Use of any such,
 ‘ renders it justly suspected for a Fable.
 ‘ What the *Egyptians* did in this Matter is
 ‘ less evident, no one Observation made by
 ‘ them being to be found in their Country-
 ‘ man *Ptolemee*, excepting what was done
 ‘ by the *Greeks* of *Alexandria*, under
 ‘ CCC Years before *Christ*. So that
 ‘ whatever was the Learning of these
 ‘ Two ancient Nations as to the Motions
 ‘ of the Stars, it seems to have been chief-
 ‘ ly Theoretical, and I will not deny but
 ‘ some of them might very long since be
 ‘ apprized of the Sun’s being the Center
 ‘ of our System, for such was the Do-
 ‘ ctrine of *Pythagoras*, and *Philolaus*, and
 ‘ some others who were said to have tra-
 ‘ velled into these Parts.

‘ From hence it may appear, That the
 ‘ *Greeks* were the first practical Astrono-
 ‘ mers, who endeavoured in earnest to
 ‘ make themselves Masters of the Sci-
 ‘ ence, and to whom we owe all the old
 ‘ Observations of the Planets, and of the

' Equinoxes and Tropicks, *Thales* was
 ' the first that could predict an Eclipse
 ' in *Greece*, not DC Years before *Christ*,
 ' and without doubt it was but a rude
 ' Account he had of the Motions; and
 ' 'twas *Hipparchus* who made the first
 ' Catalogue of the Fix'd-Stars, not above
 ' CL Years before *Christ*, without which
 ' Catalogue there could be scarce such a
 ' Science as Astronomy, and it is to the
 ' Subtilty and Diligence of that great
 ' Author, that the World was beholding
 ' for all its Astronomy for above MD
 ' Years. All that *Ptolemee* did in his *Syn-*
 ' *taxis*, was no more but a bare Tran-
 ' scription of the Theories of *Hipparchus*,
 ' with some little Emendation of the pe-
 ' riodical Motions, after about CCC Years
 ' Interval; and this Book of *Ptolemee's*
 ' was without Dispute, the utmost Perfe-
 ' ction of the Ancient Astronomy, nor
 ' was there any thing in any Nation be-
 ' fore it comparable thereto; for which
 ' Reason all the other Authors thereof
 ' were disregarded and lost; and among
 ' them *Hipparchus* himself. Nor did Po-
 ' sterity dare to alter the Theories deli-
 ' vered by *Ptolemee*, though successively
 ' *Albategnius* and the *Arabs*, and after
 ' them the *Spanish* Astronomers under *Al-*
 ' *phonsus*, endeavoured to amend the Er-
 ' rors

‘ rors they observed in their Computa-
 ‘ tions. But their Labours were fruitless,
 ‘ whilst from the Defects of their Prin-
 ‘ ciples, it was impossible to reconcile
 ‘ the Moon’s Motion within a Degree,
 ‘ nor the Planets, *Mars* and *Mercury*, to
 ‘ a much greater Space.

‘ Now in this Science to compare the
 ‘ Ancients with the Moderns, and so make
 ‘ a Parallel as just as may be, I oppose the
 ‘ Noble *Tycho Brahe*, or *Hevelius* to *Hip-
 ‘ parchus*, and *John Kepler* to *Claudius
 ‘ Ptolemee*; and I suppose no one acquaint-
 ‘ ed with the Stars will doubt, That the
 ‘ Catalogue of the Fix’d-Stars made by
 ‘ *Tycho Brahe*, about C Years since, does
 ‘ beyond Competition far excel that of
 ‘ *Hipparchus*, being commonly true to a
 ‘ Minute or Two, when the other many
 ‘ times fails half a Degree, both in Lon-
 ‘ gitude and Latitude; and this is the
 ‘ fairlier carried, for that it was as easie
 ‘ for *Hipparchus* to observe the Fixd’-Stars,
 ‘ as for *Tycho*, or *Hevelius*, had he made
 ‘ Use of the same Industry and Instru-
 ‘ ments, the Telescope wherewith we
 ‘ now observe to the utmost possible Nice-
 ‘ ty, being equally unknown to *Tycho* as to
 ‘ *Hipparchus*, and not used by *Hevelius*.
 ‘ But what may justly be expected from
 ‘ Monsieur *Cassini* and Mr. *Flamsteed* in

' this Matter, does yet further advance in
 ' preciseness, as not capable to err half a
 ' minute, though made with Instru-
 (w) p. 57. ' ments (*w*) of the Production of Gre-
 ' sham. As to the other Comparison be-
 ' tween *Kepler* and *Ptolemee*, I question
 ' not but all that can judge, will be fully
 ' convinced, that the Hypothesis of Ec-
 ' centricks, and Epicycles introduced by
 ' the Ancients only to represent the Mo-
 ' tions, and that but coarsely too; with
 ' the Opinion of *Ptolemee* himself thereon,
 ' that the natural Motions were other-
 ' wise performed, ought not to be valued
 ' against that elegant Theory of the pla-
 ' netary Motions, first invented by the
 ' acute Diligence of *Kepler*, and now late-
 ' ly demonstrated by that excellent Geo-
 ' meter *Mr. Newton*, viz. *That all the*
 ' *Planets move in Elliptick Orbs about the*
 ' *Sun, at whose Center, being placed in one*
 ' *Focus of the Eclipse, they describe equal*
 ' *Area's in equal times*; this, as it is the
 ' necessary result of the Laws of Motion
 ' and Gravity, is also found rigorously to
 ' answer to all that is observed in the Mo-
 ' tions, so that the Moderns may, with
 ' as much Reason as in any other Science
 ' whatsoever, value themselves on their
 ' having improved, I had almost said per-
 ' fected, this of *Astronomy*.

Optical

Optical Instruments have been so serviceable in the Advancement of *Astronomy*, that the Sciences which demonstrate their wonderful Properties ought next to be considered. Here also I must own my Obligation to Mr. *Halley* for this following Account of what the Ancients have done in them, and how much they have been out-done by Modern Mathematicians.

‘ I suppose there are few so thorough-
‘ paced Fautors of Antiquity, as to brag
‘ much of their Skill, either in *Opticks*,
‘ or *Dioptricks*. Their Want of *Opticks*
‘ appears in their Want of Authors treating
‘ thereon; and yet much better in
‘ their Want of *Ordonnance*, (as it is called)
‘ in their Paintings, and *Basse Relieve*’s,
‘ as has been already said in its
‘ proper Place. And as to *Dioptricks*,
‘ though some of the Ancients mention
‘ *Refraction* as a natural Effect of transparent
‘ *Media*, yet *Des Cartes* was the first
‘ who, in this Age, has discovered the
‘ Laws of *Refraction*, and brought *Dioptricks*
‘ to a Science. And the Invention
‘ of *Telescopes* and *Microscopes*; which
‘ must be wholly allowed to this Century,
‘ has received no small Improvements
‘ from the Study and Charge of Sir *Paul Neile*,
‘ and some other Members of *Gresham*.

‘*Sham*. And these are such Instruments
 ‘ of real Knowledge, that though we
 ‘ will allow the Ancients to have done all
 ‘ that great *Genii*, with due Application,
 ‘ could arrive at; yet, for want of them,
 ‘ their Philosophical Argumentation could
 ‘ not come up to the present Pitch;
 ‘ not being able to fathom the boundless
 ‘ Depths of the Heavens, nor to unravel
 ‘ the *Minutiae* of Nature, without the
 ‘ Assistance of the Glasses we are now
 ‘ possessed of’.

CHAP. XXIV.

Of Ancient and Modern Musick.

(x) Pag.
45. **S**IR William Temple having assured
 us (x), that it is agreed by the Learned,
 that the Science of Musick, so admired
 by the Ancients, is wholly lost in the World:
 And that what we have now, is made up of
 certain Notes that fell into the Fancy of a
 poor Friar, in chanting his Mattins. It
 may seem improper to speak of Musick
 here, which ought rather to have been
 ranked amongst those Sciences, wherein
 the Moderns have, upon a strict Enquiry,
 been found to have been out-done by
 the

the Ancients. I have chosen, however, to speak of it in this Place, for these following Reasons.

I. That whereas all Modern Mathematicians have paid a mighty Deference to the Ancients ; and have not only used the Names of *Archimedes*, *Apollonius* and *Diophantus*, and the other Ancient Mathematicians, with great Respect ; but have also acknowledged, that what further Advancements have since been made, are, in a manner, wholly owing to the first Rudiments, formerly taught : Modern Musicians have rarely made use of the Writings of *Aristoxenus*, *Ptolemee*, and the rest of the Ancient Musicians ; and, of those that have studied them, very few, unless their Editors, have confessed that they could understand them ; and others have laid them so far aside, as useless for their Purpose ; that it is very probable, that many excellent Composers have scarce ever heard of their Names.

II. *Musick* has still, and always will have very lasting Charms. Wherefore, since the Moderns have used their utmost Diligence to improve whatever was improvable in the Writings of all sorts of Ancient Authors, upon other equally difficult, and very often not so delightful Subjects, one can hardly imagine but that

that the World would, long ere now, have heard something more demonstrably proved of the Comparative Perfection of Ancient *Musick*, with large Harangues in the Commendation of the respective Inventors, if their Memory had been preserved, than barely an Account of the fabulous Stories of *Orpheus* or *Amphion*, which either have no Foundation at all; or, as *Horace* of old understood

(y) *Silvestres homines, sacer interpretisq; Deorum,
Cadibus & victu fædo deterruit Orpheus:
Dicitur ob hoc lenire Tigres
rabidosq; Leones.
Dicitur & Amphion, Thebana conditor arcis,
Saxa movere sono Testudinis, & prece blandâ,
Ducere quo vellet.*

Art. Poet.

them (y), are allegorically to be interpreted of their reducing a Wild and Salvage People to Order and Regularity. But this is not urged against Sir *William Temple*, who is not convinced of the Extent of Modern Industry, Sagacity, and Curiosity; though to other Admirers of Ancient *Musick*, who, upon Hear-say, believe it to be more perfect than the Modern, and yet are, for other Reasons, sufficiently convinced of the unwearied Diligence, and answerable Success of the Modern Learned, in retrieving and improving other Parts of Ancient Knowledge, it will not appear inconsiderable.

III. *Musick* is a *Physico-Mathematical Science*, built upon fixed Rules, and stated Proportions; which, one would think,

think, might have been as well improved upon the old Foundations, as upon new ones, since the Grounds of *Musick* have always been the same: And *Guido's Scale*, as Dr. *Wallis* assures us, is the same for Substance with the *Diagramma Veterum*.

IV. The Ancients had not, in the Opinion of several who are Judges of the Matter, so many Gradations of Half-Notes and Quarter-Notes between the Whole Ones as are now used; which must of necessity introduce an unspeakable Variety into Modern *Musick*, more than could formerly be had: Because it is in Notes, as it is in Numbers; the more there are of them, the more variously they may be combined together.

V. Excessive Commendations can signify nothing here, because every Man gives the highest Applauses to the perfectest Thing he ever saw, or heard, of any Kind. And if he is not capable of inventing any Thing further in that Way himself, he can form no Idea of it, beyond what himself was at that Time affected with.

VI. It is very probable that the Ancient *Musick* had all that which still most affects common Hearers. Most Men are moved with an excellent Voice, are pleased when Time is exactly kept, and love
to

to hear an Instrument played true to a fine Voice, when the one does not so far drown the other, but that they can readily understand what is sung, and can, without previous Skill, perceive that the one exactly answers the other throughout; and their Passions will be effectually moved with sprightly or lamentable Compositions: In all which Things the Ancients, probably, were very perfect. To these Men, many of our Modern Compositions, where several Parts are sung or played at the same Time, would seem confused, intricate, and unpleasant: Though in such Compositions, the greater this seeming Confusion, the more Pleasure does the skilful Hearer take in unravelling every several Part, and in observing how artfully those seemingly disagreeing Tones joyn, like true-cut Tallies, one within another, to make up that united Concord, which very often gives little Satisfaction to common Ears; and yet it is in such sort of Compositions, that the Excellency of Modern *Musick* chiefly consists. For, in making a Judgment of *Musick*, it is much the same Thing as it is of Pictures. A great Judge in *Painting* does not gaze upon an exquisite Piece so much to raise his Passions, as to inform his Judgment, as to approve, or to find fault.

fault. His Eye runs over every Part, to find out every Excellency ; and his Pleasure lies in the Reflex Act of his Mind, when he knows that he can judiciously tell where every Beauty lies, or where the Defects are discernable : Which an ordinary Spectator would never find out. The chiefest Things which this Man minds, is the Story ; and if that is lively represented, if the Figures do not laugh when they should weep, or weep when they should appear pleased, he is satisfied : And this, perhaps, equally well, if the Piece be drawn by *Raphael*, as by an ordinary Master, who is just able to make Things look like Life. So likewise in *Musick* ; He that hears a *numerous* Song, set to a very moving Tune, exquisitely sung to a sweet Instrument, will find his Passions raised, whilst his Understanding, possibly, may have little or no Share in the Business. He scarce knows, perhaps, the Names of the Notes, and so can be affected only with an Harmony, of which he can render no Account. To this Man, what is intricate, appears confused ; and therefore he can make no Judgment of the true Excellency of those Things, which seem *fiddling* to him only, for want of Skill in *Musick*. Whereas on the contrary, the Skill or Ignorance

Ignorance of the Composer serve rather to entertain the Understanding, than to gratifie the Passions of a skilful Master; whose Passions are then the most thoroughly raised, when his Understanding receives the greatest Satisfaction.

VII. It will be difficult to form a just Idea of the Pleasure which the Ancient *Musick* afforded, unless one reflects upon the confessedly unimitable Sweetness of the Ancient *Poetry*, the *Greek* especially; which, when sung by clear and sweet Voices, in such a manner, as that the Hearer never lost a Syllable, could scarce fail of producing those Emotions of Soul which the Poet intended to raise. And, indeed, the great End of *Musick*, which is to please the Audience, was anciently, perhaps, better answered than now; though a Modern Master would then have been dis-satisfied, because such Con-sorts as the Ancient *Symphonies* properly were, in which several Instruments, and perhaps Voices, played and sung the same Part together, cannot discover the Extent and Perfection of the Art, which here only is to be considered, so much as the Compositions of our Modern *Opera's*.

From all this it may, perhaps, be not unreasonable to conclude, that though
(2) those

(2) those Charms of Musick, by which Men (2) Pag.
and Beasts, Fishes, Fowls and Serpents, 45.
were so frequently enchanted, and their ve-
ry Natures changed, be really and irre-
coverably lost; yet the Art of Musick,
that is to say, of Singing, and Playing
upon Harmonious Instruments, is, in it
self, much a perfecter Thing, though,
perhaps, not much pleasanter to an un-
skilful Audience, than it ever was amongst
the Ancient Greeks and Romans.

CHAP. XXV.

Of Ancient and Modern Physick.

AFTER these *Mathematical* Sciences, it
is convenient to go to those which
are more properly *Physical*, and in our
Language alone peculiarly so called.
What these want in Certainty, they have
made up in Usefulness: For, if Life
and Health be the greatest good Things
which we can enjoy here, a Conjectural
Knowledge, that may but sometimes
give us Relief when those are in danger,
is much more valuable than a certain
knowledge of other Things, which can
U only

only employ the Understanding, or furnish us with such Conveniencies as may be spared ; since we see that several Nations which never had them lived very happily, and did very great Things in the World.

Before I begin my Comparison between *Ancient* and *Modern* Skill in *Physick*, it may be necessary to state the Difference between an *Empirick*, and a *Rational Physician* ; and to enquire how far a *Rational Physician* may reason right, as to what relates to the curing of his Patient's Distemper, though his general Hypotheses be wrong, and his Theories, in themselves considered, insufficient. An *Empirick* is properly he who, without considering the Constitution of his Patient, the Symptoms of his Disease, or those Circumstances of his Case which arise from outward Accidents, administers such *Physick* as has formerly done good to some Body else that was tormented with a Disease which was called by the same Name with this that his Patient now labours under. A *Rational Physician* is he who critically enquires into the Constitution, and peculiar Accidents of Life, of the Person to whom he is to administer ; who weighs all the known Virtues of the Medicines which may be thought

thought proper to the Case in hand ; who balances all the Symptoms, and, from past Observations, finds which have been fatal, and which safe ; which arise from outward Accidents, and which from the Disease it self : And who thence collects, which ought soonest to be removed, which may be neglected, and which should be preserved or augmented ; and thereupon prescribes accordingly.

Now it is evident, that such a Man's Prescriptions may be very valuable, because founded upon repeated Observations of the Phænomena of all Diseases. And he may form Secondary Theories, which, like *Ptolemee's Eccentrics* and *Epicycles*, shall be good Guides to Practice ; not by giving a certain Insight into the first Causes, and several Steps, by which the Disease first began, and was afterwards carried on ; but by enabling the Physician to make lucky Conjectures at proper Courses, and fit Medicines, whereby to relieve or cure his Patient. And this may be equally successful, whether he resolves every Thing into Hot or Cold, Moist or Dry ; into Acids, or *Alkali's* ; into Salt, Sulphur, or *Mercury* ; or into any Thing else. He does not know, for Instance, that Spittle, Bile, and the Pancreatick Juice, are the main Instruments of Di-

gestion ; yet he sees that his Patient digests his Meat with great Difficulty : He is sure that, as long as that lasts, the sick Man cannot have a good Habit of Body ; he finds that the Distemper arises sometimes, though not always, from a visible Cause ; and he has tried the Goodness of such and such Medicines, in seemingly parallel Cases. He may be able therefore to give very excellent Advice, though he cannot, perhaps, dive into the Nature of the Distemper so well as another Man ; who having greater Anatomical Helps, and being accustomed to reason upon more certain Physiological Principles, has made a strict Enquiry into that very Case : And so by Consequence, though he cannot be said to know so much of the Essence of the Disease as that other Man, yet, perhaps, their Method of Practice, notwithstanding the great Disparity of each others Knowledge, shall be, in the main, the same.

Though all this seems very certain, yet, in the Argument before us, it is not an easie Thing to state the Question so equally, as to satisfy all contending Sides. He that looks into the Writings of the Generality of the *Rational Physicians*, as they called themselves, by way of Eminence ; that is to say, of those who,
about

about Fifty Years ago, set up *Hippocrates* and *Galen*, as the Parents and Perfecters of Medicinal Knowledge, will find, throughout all their Writings, great Contempt of every Thing that is not plainly deducible from those Texts. On the other Hand, If he dips into the Books of the Chymical Philosophers, he will meet with equal Scorn of those Books and Methods, which they, in Derision, have called *Galenical*. And yet it is evident, that practising Physicians of both Parties have often wrought very extraordinary Cures by their own Methods. So that there seems to have been equal Injustice of all Hands, in excluding all Methods of Cure not built upon their own Principles. Here therefore, without being positive in a Dispute, about which the Parties concerned are not themselves agreed, I shall only offer these few Things. (1.) That if the Greatness of any one particular Genius were all that was to be looked after, *Hippocrates* alone seems to have been the Man, whose Assertions in the Practical Part of Physick might be blindly received: For he, without the Help of any great Assurances that we know of, did that which, if it were still to do, would seem sufficient to employ the united Force of more than one Age. He was scrupulously

exact in distinguishing Diseases, in observing the proper Symptoms of each, and taking notice of their Times and Accidents, thereby to make a Judgment how far they might be esteemed dangerous, and how far safe. Herein his particular Excellency seems to have lain; and this, in the Order of Knowledge, is the first Thing that a *Rational Physician* ought to make himself Master of; Which is a sure Argument that *Hippocrates* thoroughly understood what Things were necessary for him to study with the greatest Care, in order to make his Writings always useful to Posterity. (2.) That though we should allow the Methods of Practice used by the Ancients, to have been as perfect, nay, perfecter than those now in use, which some great Men have eagerly contended for; yet it does not follow, that they understood the whole Compass of their Profession so well as it is now understood; because it is absolutely impossible to form just Theories of all Diseases, so as to lay down the perfectest Methods of Cure possible, which shall be adapted to all Persons, in all Circumstances, till Anatomy and Physiology are perfectly known; and by Consequence, later Theories are always more esteemable, as they are raised upon newer Discoveries in
Anatomy

Anatomy and Physiology: So that we may be sure no Ancient Theories can be so excellent as some of those which have been devised by Modern Philosophers.

(3.) That if the Addition of every new Medicine be an useful Accession to the Body of *Physick*, then a new Method of preparing known Medicines; of making those Things profitable and noble Remedies, which before were dreaded as Poysons, or laid by as useless; and of trying such Experiments upon Bodies yet unexamined, as will soon and certainly discover some of their most principal Virtues must be of unspeakable Advantage, and make the Knowledge of those who possess such a Method justly more valuable than of those who want it. But this relates more particularly to Chymistry, of which enough has been said already. (4.) That if the Practice of proper Judges be a reasonable Prejudice for or against any Thing, then this Science has received vast Improvements of late Years: For now the Generality of Physicians acquiesce in Modern Theories, or, which in the present Dispute is all one, advance new ones upon Anatomical and Physical Principles, pursuant to those Discoveries which have been lately made. In their Practice they mix *Galenic* and *Chymical*

Medicines together. They own that *Gal-
lenical* Ways of preparing Drugs, ancient-
ly made use of in the Practice of *Physick*,
are, in many Cases, not so valuable as
Chymical ones. In short, though they
pay a due Respect to the Writings of the
Ancients; and in those Things where
they find by their own Experience, that
the Ancient Observations hold, follow
their Directions; yet their constant Lan-
guage, and as constant Practice, when-
soever one opposes Ancient Authorities to
them, is, *That the Ancients did very well
for their Time; but that Experience, and
further Light, has taught them better
Things.* This, I must needs own, has
very great Weight with me, who am
apt, *ceteris paribus*, to believe every Man
in his own Way; *Physicians* especially,
because their Science is entirely got by a
long Series of repeated Experiments and
Observations: So that it seems to be al-
most impossible, but that, in all such Ca-
ses, where Men have the Assistance of
former Light, and where the Subject up-
on which they employ their Pains want-
ed a great deal of that Perfection, which
those that study it have an Idea of, as still
wanting, and can only be attained by a
longer Experience, successive Ages must
make great Additions to the former Stock.

(5.) That

(5.) That though the noble Discoveries of these latter Ages might, possibly, be found in *Hippocrates*, *Aristotle* and *Galen*, yet, since no Interpreters could ever find them there, till they had been discovered anew by Modern Physicians, who followed Nature only as their Guide, these late Discoverers have an equal Right to the Glory due to such Discoveries, as the Ancients could possibly have: They both copied after the same Original; they both decyphered the same Characters, that before were unintelligible; not by reading Books, but by trying Experiments, and making Observations. And therefore *Vander Linden*, *Almeloveen*, and the rest of the Bigots for the Ancients, deal very unjustly, when they cry out, upon the Sight of any new Discovery, *This Hippocrates knew*, *This Aristotle taught*. Could these Men have made these Discoveries by studying those Ancient Authors, without the Assistance of *Dr. Harvey*, *Asellius*, *Pecquet*, *Malpighius*, or the rest? This will hold, in case these Things had really been in the Ancients: That they are not, I hope I have proved already. To which I shall only add, that former Commentators wanted neither *Greek*, nor Skill; and had such Things been in their Writings, they would infallibly have found them there. It

It is easie now to tell what Acquisitions have been made since *Galen's* Days. When *Hippocrates* lived, Anatomy was a rude, imperfect Thing: It has since been growing; and the Theories of all Diseases have been proportionably more compleat. *Chymistry* has been introduced into *Physick*; thereby the *Materia Medica* has been enlarged by some as noble Medicines as any the Ancients were acquainted with, the Nauseousness of many Medicines has been removed; and they have been made less clogging, and more efficacious, since they may be taken in lesser Quantities, and in more pleasant Vehicles; to as good, if not better purpose than before. *Botanicks* have been unspeakably enlarged; and thereby also the Dispensatories have been stocked with some excellent Remedies, that the old World was unacquainted with. If these Particulars be rightly stated, as they seem to be, they will go very far to decide the Question. And so I shall leave it, without determining any Thing positively about it.

C H A P. XXVI.

Of Ancient and Modern Natural Philosophy.

HAVING gone through with the most considerable Branches of *Natural* and *Mathematical Knowledge*, I am now to enquire into the Comparative Excellency of Ancient and Modern *Books of Philosophy*, thereby to see in which of them Nature, and its Operations, are explained best. Here I shall first enquire into the several *Methods of Philosophizing*; and afterwards, into the Intrinsic Worth of the Doctrines themselves. *Moderns* here are taken in a very strict Sence. I shall mention none who have made any (a) *Entries upon this noble Stage* (a) Pag. of *Nature* above LXXX. Years ago, since 44. the Time of those first Flights of the Restorers of Learning, that are so exceedingly applauded by Sir *William Temple*. For *Natural Philosophy* was the last Part of Knowledge which was cultivated with any particular Care, upon the Revival of Learning; though *Natural History*, which is a principal Ground-work, had been long before increasing, and a considerable Heap

Heap of Materials had been collected, in order to the Work.

As for *Modern Methods of Philosophizing*, as compared with the *Ancient*, I shall only observe these following Particulars. (1.) No Arguments are received as cogent, no Principles are allowed as current, amongst the celebrated Philosophers of the present Age, but what are in themselves intelligible ; that so a Man may frame an Idea of them, of one sort or other. Matter and Motion, with their several Qualities, are only considered in Modern Solutions of Physical Problems.

(b) Pag.
46.

Substantial Forms, Occult Qualities (b), Intentional Species, Idiosyncrasies, Sympathies and Antipathies of Things, are exploded ; not because they are Terms used by Ancient Philosophers, but because they are only empty Sounds, Words whereof no Man can form a certain and determinate Idea. (2.) Forming of Sects and Parties in Philosophy, that shall take their Denominations from, and think themselves obliged to stand by the Opinions of any particular Philosophers, is, in a manner, wholly laid aside. *Des Cartes* is not more believed upon his own Word, than *Aristotle* : Matter of Fact is the only Thing appealed to ; and Systems are little further regarded, than as they are proper to instruct

struct young Beginners, who must have a general Notion of the whole Work, before they can sufficiently comprehend any particular Part of it; and who must be taught to reason by the Solutions of other Men, before they can be able to give Rational Solutions of their own: In which Case, a false Hypothesis, ingeniously contrived, may now and then do as much Service as a true one. (3.) Mathematicks are joyned along with Physiology, not only as Helps to Men's Understandings, and Quickners of their Parts; but as absolutely necessary to the comprehending of the Oeconomy of Nature, in all her Works. (4.) The new Philosophers, as they are commonly called, avoid making general Conclusions, till they have collected a great Number of Experiments or Observations upon the Thing in hand; and, as new Light comes in the old Hypotheses, fall without any Noise or Stir. So that the Inferences that are made from any Enquiries into Natural Things, though perhaps set down in general Terms, yet are (as it were by Consent) received with this Tacit Reserve, *As far as the Experiments or Observations already made, will warrant.*

How

How much these Four Things will enlarge Natural Philosophy is easie to guess. I do not say that none of these things were anciently done ; but only that they were not then so general. The *Corpuscular Philosophy* is in all Probability the oldest, and its Principles are those intelligible ones I just now commended. But its Foundations being very large, and requiring much Time, Cost, and Patience to build any great Matters upon, it soon fell; before it seems to have been thoroughly understood. For it seems evident, That *Epicurus* minded nothing but the raising of a Sect, which might talk as plausibly as those of *Aristotle*, or *Plato*, since he despised all Manner of Learning, even Mathematicks themselves, and gloried in this, that he spun all his Thoughts out of his own Brain ; a good Argument of his Wit indeed, but a very ordinary one of that Skill in Nature, which *Lucretius* extols in him every time that he takes Occasion to speak of him. The whole Ancient Philosophy looks like a thing of Ostentation and Pomp, otherwise I cannot understand why *Plato* should reprove *Eudoxus* and *Archytas*, for trying to make their Skill in Geometry useful in Matters of civil Life, by inventing of Instruments of publick Advantage ; or think that

that those sublime Truths were debased when the unlearned part of Mankind have been the better for them. And therefore, as *Plutarch* complains in his *Life of Marcellus*, Mechanical Arts were despised by Geometers till *Archimedes's* Time: Now though this be particularly spoken there by *Plutarch* of the making of Instruments of Defence and Offence in War, yet it is also applicable to all the Ancient Philosophy and Mathematicks in general. The old Philosophers seemed still to be afraid that the common People should despise their Arts if commonly understood; this made them keep for the most Part to those Studies which required few Hands and Mechanical Tools to compleat them: Which to any Man that has a right Notion of the Extent of a natural Philosopher's Work, will appear absolutely necessary. Above all, the Ancients did not seem sufficiently to understand the Connection between Mathematical Proportions of Lines and Solids, in an abstracted Proposition, and in every Part of the Creation; at least in their reasonings about the Causes of Natural Things, they did not take any great pains to shew it. When *Galen* was to give an Account of Vision in his Books (c) *De Usu Partium*, because he had

(c) De U.
P. lib. X.
cap. 12,
13, 14.

had Occasion to use some few Geometrical Terms, as *Cone*, *Axis*, *Triangle*, and the like; he makes a long Excuse, and tells a tedious Story of a Dæmon that appeared to him, and commanded him to write what he did; and all this least the Physicians of that Age should think that he conjured, and so take a Prejudice against all that he said. This shews that in *Galen's* Time at least, there was little Correspondence between Mathematical and Physical Sciences, and that Mankind did not believe that there was so intimate a Relation between them as it is now generally known there is. Many a Man that cannot demonstrate any one single Proposition in *Euclid*, takes it now for granted that Geometry is of infinite Use to a Philosopher; and it is believed now upon trust, because it is become an Axiom amongst the Learned in these Matters. And if it had been so received in *Galen's* Time, or by those more ancient Authors, whom *Galen's* Contemporaries followed, or pretended at least to follow, as their Patterns; such as *Hippocrates*, whom all sides revered, *Herophilus*, *Erasistratus*, *Asclepiades*, and several more, there would have been no need of any Excuses for what he was doing; since his Readers being accustomed to such

such sort of Reasonings, would either readily have understood them, or acquiesced in them as legitimate Ways of Proof. If Three, or Four Mathematical Terms were so affrighting, how would those learned Discourses of *Steno* and *Croone*, concerning muscular Motion have moved them? How much would they have been amazed at such minute Calculations of the Motive-strength of all sorts of Muscles in the several general sorts of Animals, as require very great Skill in Geometry, even to understand them, which are made by *Borellus* in his Discourses of *the Motion of Animals*? It is not enough in this Case, to quote a Saying or Two out of some great Man amongst the Ancients, or to tell us that *Plato* said long ago, *That God geometrizes in all his Works*; as long as no Man can produce any one Ancient Essay upon any one Part of Physiology, where Mathematical Ratiocinations were introduced to salve those Phænomena of Natural Things, upon which it was possible to talk plausibly without their Help. At least it is certain, That they contented themselves with general Theories, without entring into minute Disquisitions into the several Varieties of Things, as is evident in the Two Cases already alledged, of *Vision* and *Muscular Motion*.

X

Now

Now as this Method of Philosophizing laid down above, is right, so it is easie to prove that it has been carefully followed by Modern Philosophers. My Lord *Bacon* was the first great Man who took much pains to convince the World that they had hitherto been in a wrong Path, and that Nature her self, rather than her Secretaries, was to be addressed to by those who were desirous to know very much of her Mind. Monsieur *Des Cartes*, who came soon after, did not perfectly tread in his Steps, since he was for doing most of his Work in his Closet, concluding too soon, before he had made Experiments enough ; but then to a vast Genius he joined exquisite Skill in Geometry, and working upon intelligible Principles in an intelligible Manner ; though he very often failed of one Part of his End, namely, a right Explication of the Phænomena of Nature, yet by marrying Geometry and Physicks together, he put the World in Hopes of a Masculine Off-spring in process of Time, though the first Productions should prove abortive. This was the State of Natural Philosophy, when those great Men who after King *Charles II's* Restoration joined in a Body, called by that Prince himself, the *ROYAL SOCIETY*, went on with the Design ; they made it their Business

finess to set their Members a work to collect a perfect History of Nature, in order to establish thereupon a Body of Physicks; what has been done towards it by the Members of that illustrious Body will be evident by considering that Boyle, Barrow, Newton, Huygens, Malpighius, Leeuwenhoek, Willoughby, Willis, and Abundance more already named amongst the great Advancers of real Learning, have belonged to it: If it shall be thought too tedious a Work to examine all their Writings, Mr. Boyle's Works, any one good System of the Cartesian Philosophy, Monsieur Rohault's for Instance, or to comprehend all under one, a Book Intituled, *Philosophia Vetus & Nova ad Usum Scholæ accommodata*, may be consulted, and then it will be evident enough of which Side the Verdict ought to be given; in the last Book especially it is evident how very little the Ancients did in all Parts of Natural Philosophy, and what a great Compass it at present takes, since it makes the Comparison I all along appeal to.

Thus, it seems to me to be very evident, That the Ancients Knowledge in all Matters relating to *Mathematicks* and *Physicks* was incomparably inferiour to that of the Moderns. These are Subjects,

many of them at least, which require great Intensity of Thought, great Strength and Clearness of Imagination, even only to understand them, how much more then to invent them? The Ancient *Orators*, who spoke so great things in Praise of *Eloquence*, who make it so very hard a thing to be an Orator, had little or no Notion of the Difficulty of these Sciences; the *Romans* especially who despised what they did not understand, and who did not without some Indignation learn of a People whom themselves had conquered. But if they could have conceived what a Force of Genius is required to invent such Propositions as are to be found in the Writings of their own Mathematicians, and of the Modern Geometers and Philosophers, they would soon have acknowledged that there was need of as great at least, if not greater Strength of Parts and Application to do very considerable things in these Sciences as in their own admired Eloquence, which was never more artfully employed than in commending itself: The Panegyrics which they made upon Geometry, were rather Marks of their Pedantry than of their Skill; *Plato* and *Pythagoras* admired them, and therefore they did so too, out of a blind Reverence to those great Names. Otherwise
amongst

amongst those numerous Commendations which are given to *Archimedes*, some would have been spent upon the many noble Theorems which he discovered, and not almost all upon the Engines where-with he baffled *Marcellus* at the Siege of *Syracuse*. The Proposition, *That the Superficies of a Sphere is equal to the Area's of Four of its greatest Circles*, which is one of the most wonderful Inventions that was ever found in Geometry, shews him to have been a much greater Man, than all that is said of him by the *Roman*, or *Greek* Historians. Had experimental Philosophy been anciently brought upon the Stage, had Geometry been solemnly and generally applied to the Mechanism of Nature, and not solely made use of to instruct Men in the Art of Reasoning, and even that too, not very generally neither, the Moderns would not have had so great Reason to boast as now they have: For these are things which come under ocular Demonstration, which do not depend upon the Fancies of Men for their Approbation, as Oratory and Poetry very often do. So that one may not only in general say that the Ancients are out-done by the Moderns in these Matters, but also assign most of the particulars, and determine the Proportion

wherein and how far they have been exceeded, and shew the several Steps whereby this sort of Learning has from Age to Age received Improvement; which ends Disputes and satisfies the Understanding at once.

C H A P. XXVII.

*Of the Philological Learning of
the Moderns.*

Hitherto in the main I please my self, that there cannot be much said against what I have asserted, though I have all along taken Care not to speak too positively, where I found that it was not an easie Thing to vindicate every Proposition without entring into a Controversy, which would bear plausible things on both sides, and so might be run out into a Multitude of Words, which in Matters of this kind are very tiresome. But there are other Parts of Learning still behind, where the very offering to compare the Moderns to the Ancients may seem a Paradox; where the subject Matter is entirely ancient, and is chiefly, if not altogether contained in Books that were written

written before the Ancient Learning suffered much Decay.

Under this Head *Philology* and *Divinity* may very properly be ranked. I place *Divinity* last to avoid Repetition, because what I have to say concerning Modern *Philology* will strengthen many things that may be urged in the Behalf of Modern *Divinity* as opposed to the Ancient.

In speaking of the Extent and Excellency of the *Philological Learning* of the Moderns within these last 200 Years, I would not be mis-understood. For the Question is not whether any Modern Critick has understood *Plato* or *Aristotle*, *Homer* or *Pindar*, as well as they did themselves, for that were ridiculous; but whether Modern Industry may not have been able to discover a great many Mistakes in the Assertions of the Ancients about Matters not done in their own Times, but several Ages before they were born. For the Ancients did not live all in one Age, and though they appear all under one Denomination, and so as it were upon a Level, like things seen at a vast Distance, to us who are very remote from the youngest of them; yet, upon a nearer View, they will be found very remote each from the other; and so as liable to Mistakes when they talk of Matters not

transacted in their own Times, as we are when reason of Matters of Fact, which were acted in the Reign of *William the Conquerour*. Wherefore if one reflects upon the Alteration which Printing has introduced into the State of Learning, when every Book once printed becomes out of Danger of being lost, or hurt by Copiers; and that Books may be compared, examined, and canvassed with much more Ease than they could before, it will not seem ridiculous to say, That *Joseph Scaliger*, *Isaac Casaubon*, *Salmasius*, *Henricus Valesius*, *Selden*, *Usher*, *Bochart*, and other Philologists of their Stamp, may have had a very comprehensive View of Antiquity, such a one as Strangers to those Matters, can have no Idea of; nay a much greater than, taken altogether, any one of the Ancients themselves ever had, or indeed, could have. *Demosthenes* and *Aristophanes* knew the State of their own Times better than *Casaubon* or *Salmasius*: But it is a Question whether *Boëthius* or *Sidonius Apollinaris* knew the State of *Demosthenes's* Time so well; yet these also are Ancients to us, and have left behind them Writings of a very estimable Value. Literary Commerce was anciently not so frequent as now it is, though the *Roman* Empire made it more easie than otherwise it could have been. In

In *Ecclesiastical Antiquity* this can be more fully proved than it can in *Civil*; because Monuments of that Kind are more numerous, and have been better preserved. How widely were the *Greek* Writers many times mistaken, when they gave an Account of the Affairs of the *Latin* Churches. And how very imperfect, many Times, were the Accounts which the *Western* Churches had of Things of the greatest Moment that had been determined in the *East*? Though the Council of *Nice* was Oecumenical, yet the *African* Churches knew so little of its Canons above Fifty Years after it was held, that the Bishops of *Rome* imposed Canons made in another Council, held several Years after, in another Place, upon them, as Canons made in the Council of *Nice*: Yet they were all, at that Time, under one common Government, and these Things were acknowledged by all Sides to be of Eternal Concernment. The same Negligence, if not greater, is discernable in Matters which were studied, rather as Recreation and Diversion, than as necessary Business. How many of the Ancients busied themselves about Examining into the Antiquities of several Nations, especially after the *Old Testament* was translated into *Greek*? Yet how few
of

of them understood the Languages of those Countries of which they disputed? There were but two of the Ancient Fathers, that we know of, that pretended to Learning, who understood *Hebrew* accurately; *Origen*, and *St. Hierom*: And how well *St. Hierom* understood it, is now certainly known; not like the *Light-foot's*, the *Buxtorf's*, the *Drusius's*, and the *Cappell's* of the present Age, one may be very well assured: The other *Oriental* Languages, even these Inquisitive Fathers knew very little, or nothing, of. To how good purpose they have been cultivated by the Moderns, the Writings of *Selden*, *Boschart*, *Pocock*, and several others, do abundantly declare. When *Pocock* and *Golinius* went into the *East*, to bring away their Learning, they went to very good purpose indeed. The *Bodleian* and *Leyden-Libraries* can witness what vast Heaps of *Eastern MSS.* have been brought by such Men as these, into *Europe*. One would think I were drawing up a Catalogue, not writing of a Letter, if I should enumerate the Books which have been printed about the *Oriental* Learning, within these last Seventy Years: And how much they have enlightned all manner of Antiquity, is easie to tell.

How

How clearly has the *Old Chronology* and *Geography* been stated by Modern Critics and Philologers ; and the Mistakes and Carelessness of many Writers detected, who were esteemed Authentick even in the Times wherein they lived ? *Selden* and *Bochart*, to name no more at present, have plainly proved, that all the Ancient *Greek* Antiquaries were not near so well acquainted with the Originals of that *Mythology*, which then made up a good part of their Religion, as well as of their Learning, as it is known at present, since the Languages of those Countries, from whence most of those Rites and Stories took their Original, have been carefully examined, and critically studied. Is it not a very odd Thing, that of so many as have written of the *Pyramids*, there should not be one exact Account of them, Ancient nor Modern, till *Mr. Greaves* described them ? They were admired formerly, as much as now (d) ; reckoned amongst the Seven Wonders of the World ; and mentioned, from *Herodotus*'s Time, downwards, by all that gave any Account of *Egypt* : Yet most Men copied after *Herodotus* ; and many of the rest, who did not, spoke by guess. None of the extant Ancient Authors was so exact as *Sir George Sandys*, who wanted

(d) *Barbara Pyramidum sileat miracula Memphis. Martial.*

ed nothing but Mathematical Skill, to have left nothing for Mr. *Greaves*, who came after him, to do. This is an eminent Instance, whereby we may give a certain Judgment of the Historical Exactness of the Ancients, compared to that of the Moderns. It may be improved to considerable Purposes; at least, it is of great use to justify those Modern Writers, who have, with great Freedom, accused some of the Greatest of the Ancients, of Carelessness in their Accounts of Civil Occurrences, as well as of Natural Rarities; and who have dared to believe their own Reason, against the positive Evidence of an old Historian, in Matters wherein one would think that he had greater Opportunities of knowing the certain Truth, than any Man that has lived for several Ages.

But here I expect that it should be objected, that this is not to be esteemed as a Part of Real Learning. To pore in old *MSS.* to compare various Readings; to turn over *Glossaries*, and old *Scholia* upon Ancient Historians, Orators and Poets; to be minutely critical in all the little Fashions of the Ancient *Greeks* and *Romans*, the Memory whereof was, in a manner, lost within Fifty or an Hundred Years after they had been in use; may be good
Argu-

Arguments of a Man's Industry, and Willingness to drudge ; but seem to signify little to denominate him a great Genius, or one who was able to do great Things of himself. The Objection is specious enough, and the Indiscretions of many Modern Commentators have given but too much Colour for it ; which has, in our Nation especially, been riveted in Men's Minds, more, perhaps, than in any other learned Nation in *Europe* : Tho in Enquiries into the remotest Antiquities of the oldest Nations, perhaps no People have done near so much as some learned *English*-Men. But this Objection lies chiefly against the Men, not the Knowledge, the Extent whereof it is only my Business to enquire into ; and yet, even there too, it is without Ground ; for, whoever will be at the pains to reflect upon the vast Extent of the various Knowledge which such Men as those I named before had treasured together, which they were able to produce to such excellent Purposes in their Writings, must confess that their *Genius's* were little, if at all, inferiour to their *Memories* ; those among them especially, who have busied themselves in restoring corrupted Places of Ancient Authors. There are Thousands of Corrections and Censures upon Authors to be found

found in the Annotations of Modern Criticks, which required more Fineness of Thought, and Happiness of Invention, than, perhaps, Twenty such Volumes as those were, upon which these very Criticisms were made. For, though, generally speaking, good Copies are absolutely necessary; though the Critick himself must have a perfect Command of the Language and particular Stile of his Author, must have a clear Idea of the Way and Humour of the Age in which he wrote; many of which Things require great Sagacity, as well as great Industry; yet there is a peculiar Quickness in Discerning what is proper to the Passage then to be corrected, in distinguishing all the particular Circumstances necessary to be observed, and those, perhaps, very numerous; which raise a judicious Critick very often as much above the Author upon whom he tries his Skill, as he that discerns another Man's Thoughts, is therein greater than he that thinks. And the Objection that is commonly made against Editors of old Books, That every Man cries up his own Author, beyond all that have ever wrote upon that Subject, or in that Way, will rarely hold of truly great Criticks, when they pass their Judgments, and employ their Thoughts upon
indif-

indifferent Books ; since some have taken as much Pains, in their Critical Annotations (e), to expose Authors who have had the good Luck to be exceedingly commended by learned Men, as ever others did to praise them.

(e) *Vide Petri Cunæi Animadversiones in Nonni Dionysii*
ca.

Soon after Learning was restored, when Copies of Books, by Printing, were pretty well multiplied, *Criticism* began ; which first was exercised in Setting out Correct Editions of Ancient Books ; Men being forced to try to mend the Copies of Books, which they saw were so very negligently written. It soon became the Fashionable Learning ; and after *Erasmus*, *Budæus*, *Beatus Rhenanus* and *Turnebus* had dispersed that sort of Knowledge through *England*, *France*, *Germany*, and the *Low-Countries*, which before had been kept altogether amongst the *Italians*, it was, for about One Hundred and Twenty Years, cultivated with very great Care : And if since it has been at a Stand, it has not been because the Parts of Men are sunk ; but because the Subject is, in a manner, exhausted ; or, at least, so far drained, that it requires more Labour, and a greater Force of Genius, now to gather good Gleanings, than formerly to bring home a plentiful Harvest ; and yet this Age has produced
Men

Men who, in the last, might have been reckoned with the *Scaligers*, and the *Lipsius's*. It is not very long since *Holstenius*, *Bochart*, and *Gerhard Vossius* died; but if they will not be allowed to have been of our Age, yet *Isaac Vossius*, *Nicholas Heinsius*, *Frederick Gronovius*, *Ezekiel Spanheym* and *Grævius* may come in; the two last of them are still alive, and the others died but a few Years since. *England*, perhaps, cannot shew a proportionable Stock of Criticks of this Stamp. In *Henry VIII's* Time there was an admirable Set of Philologers in the Nation; though there is great difference to be made between a good Critick, and a Man that writes *Latin* as easily and correctly as his Mother-Tongue. *Sir Thomas More*, *Cardinal Poole*, *Linacre*, *Collet*, *Cheek*, *Ascham*, and several more, often to be met with in *Erasmus's Epistles*, wrote *Latin* with a Purity that no *Italian* needed then to have been ashamed of. Let the Subject they wrote have been what it would, one may see by the Purity of their Stile, that they wrote in a Language which expressed their Thoughts without Constraint. A great Familiarity with the politest Authors of Antiquity was what these Men valued themselves much upon; and it was then the Delight of the Nation,

as

as much as their Disputes in Religion would give them Leave, Though this seemed to sink by degrees, yet that afterwards Critical Skill in Antiquity was valued and pursued by our learned Men, will not be questioned by those who consider that Sir *Henry Savile*, Mr. *Cambden*, Archbishop *Usher*, Mr. *Selden*, Sir *John Marsham*, Mr. *Gataker* (not to mention some now alive, whose Fame will one Day equal that of the *Scaligers* and the *Grotius's* of other Nations) were the Glories of our Country, as well as of the Age they lived in.

In short, to conclude this Argument: Though Philological and Critical Learning has been generally accused of Pedantry, because it has sometimes been pursued by Men who seemed to value themselves upon Abundance of Quotations of *Greek* and *Latin*, and a vain Ostentation of diffused Reading, without any Thing else in their Writings to recommend them; yet the Difficulty that there is, to do any Thing considerable in it, joyned with the great Advantages which thereby have accrued to the Commonwealth of Learning, have made this no mean Head whereon to commend the great *Sagacity*, as well as *Industry* of these later Ages.

CHAP. XXVIII.

*Of the Theological Learning of the
Moderns.*

TO Philology I before added Divinity, and, as I hope to prove, not without Reason. As they relate to our Question, they both agree in this, that the Subject of them both is truly Ancient; and that it is impossible to become very excellent in either of them, without a familiar Conversation with those Original Books, to which the great Masters of both these Sciences do constantly appeal. Our *Blessed Saviour* did not reveal his Law by Halves to his Apostles, nor is the *New Testament* an imperfect Rule of Faith: The *Old Testament* likewise has constantly been at hand; and the *Jews* have, ever since their Return from the *Babylonish Captivity*, been scrupulously solicitous to preserve the

(f) *Genuine Hebrew and Chaldee Text of the Old Testament*, pure and uncorrupted, (f) *whether we have any Thing more Ancient than the Augustan Age of the old Hebrew and Chaldaean Languages, that is Genuine. It may be said, that he designed to except the Old Testament; which I believe he did: However, there being no Restriction in his Words, he himself must own that it is loosely expressed.*

to succeeding Ages. Yet, though these, together with the Writings of the *Greek* and *Latin* Fathers, be Instruments without which no Divine can work; and though it seems almost impossible that any Man should be able to perform all the Duties of his Profession, that are incumbent upon him as a Scholar, without a competent Exactness in all these Things; yet it is very possible that Modern Divines, who make use of these Instruments, may be better Work-men than those Ancient Fathers, who furnished them with the greatest part.

Now, that there may be no Disputes about Terms mis-understood, it will be necessary to explain what is here meant by *a perfect Divine*; that is to say, such an one as may be a Standard whereon to found a Comparison. *A perfect Divine* ought to understand the Text of the *Old* and *New Testament* so exactly, as to have a clear Notion of every Book in general, and of the Grammatical Meaning of every Text in particular; that so he may be able to reconcile all Difficulties, and answer all Objections that may arise: He ought to understand the State of the Church, as to its Doctrine and Discipline, in its several Ages: He ought to be thoroughly versed in all the General Notions

of *Ethicks*, taken in their utmost Extent, to enable him to resolve such Cases of Conscience as may occur, with Judgment and Satisfaction; he ought to be a Master of all the Topicks of Perswasion which can ever lie in his Way, that so his Exhortations may please and convince those whom he designs to perswade at the same Time; last of all he ought to be able to answer all the Objections which may be, or have been raised against the Doctrine and Discipline of the Church, by its open or secret Enemies. These seem to be the necessary Qualifications of a *Perfect Divine*; it may perhaps, be questioned whether any Man did ever fully come up to this Description; neither is it necessary that any should, since the Question will be as perfectly answered by determining who have come the nearest to it, as by assigning any particular Person that ever quite reach'd up to it. For these Differences do not lie in a Mathematical Point, and I do not desire that any disputable things should ever be brought under Debate. One Qualification indeed, and that the greatest of all, I have omitted; but that relates not to the present Controversie, since we are not now enquiring who were the holiest Men, but who have been the greatest Masters of
of

of their Professions, the ancient Fathers or the Modern Divines.

The first thing required, is an exact Knowledge of the Text of the Old Testament. Herein even the LXX Interpreters themselves have often failed, as has been abundantly proved by Modern Criticks. The Copies they used were sometimes faulty, and since they did not mend those Faults, it is very probable they did not see them. It has been observed already, That scarce any of the Fathers understood *Hebrew* besides *Origen* and *St. Hierom*, who therefore were followed as Oracles by many of their Successors; even that alone will not suffice, because there are no other Books written in that Language: For which Reason *Syriac*, *Chaldee*, *Samaritan* and *Arabic*, have been studied by Modern Criticks; not to mention the Writings of the *Rab- bins* and the *Talmudists*, to which the Ancients were utter Strangers. If we come to Particulars, who of the Ancients ever unravelled the Chronology of the Old Testament like Archbishop Usher, and Sir John Marsham? Though *Eusebius's* *Chronicon* is a standing Evidence how much he, and *Julius Africanus* before him, endeavoured to clear that Matter, which was of so great Use to confound the

vain Pretences to Antiquity of those other Nations that were so very unwilling to yield to the *Jews* in this Particular. Who has ever given so rational and so intelligible an Account of the Design and Intent of the several parts of the ceremonial Law as Dr. *Spencer*? Who has acquainted the World with the Geography of *Genesis*, or the Natural History of the Bible, like Monsieur *Bochart*? These are much harder things than the lengthning of a fine-spun Allegory, or than a few moral Reflections which constitute the greatest part of the Ancient Comments. But the New Testament, you will say, was written in a Time that was nearer at Hand; and so was certainly better understood. Without doubt it was, by the First Fathers; for which Reason their Interpretations (g) and their Reasonings, if we could have recovered many of them would have been of infinite Value: But when once the Synagogue and the Church broke off all their Correspondence, when once the immediate Reasons of the first Establishment of many Parts of the Christian Discipline, and of great Numbers of Allusions to *Jewish* Customs and Traditions which are to be found in the New Testament, could only be known by Study and Reading, all which the first Christians

(g) See
Mr. Dod-
well's Two
First Dis-
sertations
upon S. I-
renæus.

Christians knew without Study, as we do the Manners and Fashions of our own Age and Country, then the ancient Interpretations of the New Testament began to fail, and though some of them, *S. Chrysostom's* and *Theodore's* especially, are in themselves, setting Antiquity aside, truly valuable; yet, for want of such a diffused Knowledge of Eastern Antiquities as was necessary, and which only could be had by a long Conversation with the Books that are written in those Languages, these admirable Commentators seem in several Places not to have found out the true Original of many things in the New Testament which have been discovered since.

To the next Thing, which is Skill in *Ecclesiastical Antiquity*, I have spoken already. The *Third* and the *Fourth*, which relate to a Divine as a *Casulist*, or as a *Preacher*, may be considered of together, wherein we of the present Age may, without Vanity, boast of having the best Books, and of them too the greatest Numbers, upon these Subjects, written in our own Language, and by our own Countrymen, of any People in the World. The Excellency of a *Casulist* is to give such Resolutions of Doubts and Questions proposed to him, as may both suit with the

particular Circumstances of the Person who desires Satisfaction; and also may be perfectly agreeable to the Law of God. *A Preacher* then seems to perform his Office best, when he can at once instruct and move his Auditors; can raise their Passions, and inform their Judgment: That so every Sermon upon a Doctrinal Head may contain the Solution of a Case of Conscience. For the first of these; It is certain that many of the ablest of the Ancient Fathers were very excellent Casuists; as, indeed, every Man who has a right Judgment, an honest Mind, and a thorough Acquaintance with the Design of our *Blessed Saviour*, revealed in the Gospel, must of necessity be. And if, at this distance, many of their Decisions seem over-severe, there is as great, at least, if not greater Reason to suspect, that the Complaints now-a-days raised against them, may arise from our Degeneracy, as from their unwarrantable Strictness. But for the *Ancient Way of Preaching*, there is much more to be said. The great Handle by which an Hearer is enabled to carry along with him a Preacher's Arguments, is, Method and Order. Herein the Ancient Homilists are very defective: Flights of Rhetorick, which are more or less judiciously applied, according

according to the Abilities of the several Preachers, make up the greatest part of their Discourses: And, after *Origen*, most Men busied themselves in giving the People Allegorical Interpretations of Passages of Scriptures, which were infinite, according to the Fancies of those that used them. *St. Chrysostom*, indeed, reformed this Custom in the *Greek Church*: His Authority went very far; and his Interpretations were almost always Literal, and, suitably to his vast Genius, very judicious. But he that considers Preaching as an Art capable of Rules and Improvement, will find a mighty Difference between a just, methodical Discourse, built upon a proper Text of Scripture, wherein, after the Text is carefully explained, some one Duty or Doctrine of Religion, thence arising, is plainly proved by just and solid Arguments, from which such Topicks of Persuasion are drawn at last, as are the most likely to raise such an Affection, and engage those Passions in the Minds of all the Auditors as will please and move good Men, and silence, at least, if not persuade the Bad; and between a loose, paraphrastical Explication of a large Portion of Scripture, which ends at last in a general Ethical Harangue, which is the usual Method of most of
St. Chry-

St. *Chrysostom*'s Homilies. Whereas by the former Method, strictly followed, very many of our *English* Sermons, especially those of the Great Men of our own Church, since the Restauration, are Solutions of the most difficult Questions in Divinity, and just Discourses upon the several Duties of the Christian Life; and this with so much Smoothness, so great Beauty of Language, and such a just Application of the greatest Ornaments of True and Masculine Eloquence, to Things at first View very often the most opposite, that the Hearer takes a Pleasure to think, that then he is most instructed, when he is best pleased. The Want of this Method in the Ancient Homilists, is the great Reason why they are so little read. It is not because they are hard to be understood; for an indifferent Skill in *Greek* and *Latin* is sufficient to go through with the greatest part of them: But Want of Method, great Multiplicity of Words, and frequent Repetitions, tire out most Readers: They know not how far they are got, but by the Number of the Leaves; and so having no Rest for their Minds to lean upon, when once they begin to be weary, they are soon

soon disgusted. If therefore these Inconveniences are, in a great Measure, avoided by Modern Preachers, their Sermons are, in their Kind, more perfect, though the Matter which both of them work upon be the same. And if these Things be the Effects of great Study, and of an exact Judgment, at least in those who contributed the most to so great an Alteration, then this also may come in as a proper Evidence of the Increase of Modern Learning; and with much more Reason than those Things which only tend to divert a Man when he is unfit for serious Business. Who those are who have succeeded the *Hookers*, the *Chilblingworths*, the *Sanderfons*, and the *Hammonds* of this last Age, to such excellent purpose for the present, and those that shall come after, I need not name; but shall rather conclude with that Saying in *Velleius Paterculus*, upon a not much unlike Occasion; *Vivorum ut admiratio magna, ita censura difficilis est.*

The last Thing which I mentioned as necessary for a Divine, is, *To be able to answer such Objections as have been, or may be raised against the Christian Faith.* Of the Controversies which have

have arisen among Christians, and the Adversaries with whom they have been obliged to engage, there are in the present Account two Sorts ; those which the Ancient Fathers were concerned with, and those that appeared since. Of the Latter it may, possibly, seem hard to pass a Judgment, since one cannot well say how Men would have managed Disputes which never came in their Way. The former may also be sub-divided into those which have been renewed in our own Time ; and those of which we have only the Memory in Ancient Books. So that one is rather to consider how Controversies were handled in general, and so infer how these Modern ones would have been managed, had there been an Occasion, which have only engaged the Wits and Passions of later Ages.

It is evident, that in their first Disputes with the *Gentiles*, the old Apologists did, with great Accuracy, expose both the Follies of their Worship, and the Vanity of their Philosophy : They opened the Christian Religion with great Clearness ; they showed the Grounds of their Belief, and proved its Reasonableness upon such Principles as were both solid in themselves, and suitable

table to the Ways of Arguing, and the peculiar Notions of all their several Adversaries. Afterwards, when the Myſteries of the Chriſtian Religion were ſo eagerly debated, in Ages wherein they feared no Foreign Force, they ſhewed as great Subtilty in their Arguments, and as great Dexterity in ſhifting off the Sophiſms of their Opponents, as have ever been ſhewed in later Times. So that thus far the Moderns ſeem to have little Advantage: And, indeed, the Books that were written in Defence of the Chriſtian Religion were very admirable: But in the Controverſies that were managed amongſt themſelves, there ſeem to be, many Times, as viſible Signs of too great a Subtilty, as of a judicious Underſtanding of the Point in hand: They uſed little Method in ranging their Arguments, and rarely ſtated the Queſtion in plain and ſhort Terms; which made them often multiply Words to a tedious Length, that both tired the Readers, and darkned the Diſpute. That all theſe Faults are too often found in the Polemical Diſcourſes of the Moderns, is moſt certain: But Compariſons are always laid between the ableſt Men of both Sides.

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The Modern Defences of the Doctrines of the *Trinity*, and the *Incarnation*, may be compared with the old Defences of the same Doctrines against the *Arians*, and other Ancient Hereticks. If Hereticks may be compared with Hereticks, there is no Question but the *Socinians* are much abler Disputants than the *Arians* and *Eunomians* of old: They have collected every Thing that could look like an Argument; they have critically canvassed every Text of Scripture which anciently was not so Grammatically understood as now it is, and have spared no Pains nor Art to wrest every Thing that, with any Shew of Reason, could be drawn to their Side: They have refined upon the Philosophical Notions of God, and of his Attributes; and have taken great Care not to confound their Readers, or themselves, with Want of Method, or a Multiplicity of Words. Such able Adversaries have not failed of as able Opponents. And when Men of Skill manage any Dispute, whatsoever it be, they will teach one another the Art of Reasoning, even though before-hand they should not well have understood it, when their Debates continue to any Length.

Length. Whence also it has followed, that though these Great Men, who have defended our Faith against such subtle Adversaries would have shewn their Skill equally upon any other Subject which they should have undertook; yet upon these Questions, the Truth would otherwise have never been so perfectly known.

And here it ought to be observed, that the Art of making Controversies easie and intelligible, even though the Arguments should be all the same that had formerly been urged, shews much greater Skill, and a more thorough Understanding of those Matters, than had been discovered before: For, he that makes another understand a Thing in few Words, has a more clear and comprehensive Knowledge of that Thing, than another Man who uses a great many. Such a Man's Excursions, if he has a Mind at any Time to go out of the Way, or to enlarge, for the Ease of those who love to have Things expressed in an Homiliticall Manner, will never tire; because, having his Point still in view, he will take Care that his Readers or Auditors shall always know where he is. Hence it is, that there are many Sermons

mons in our Language, upon the most abstruse Questions in the Christian Religion, wherein *English* Readers who never read Fathers nor School-men; whose Heads have never been filled with Terms of Art, and Distinctions many Times without a Difference, may both in few, and clear Propositions, know what they are to believe, and at the same Time know how to defend it. Hereby in all our *Controversies* with *Papists*, *Socinians*, and *Dissenters*, many admirable Discourses have been written, wherein one sees the Question rightly stated, presently brought to an Head, and accurately proved by such Arguments as its particular Nature may require. It cannot be denied, but a good deal of this Methodical Exactness was at first owing to the School-men; but they are Moderns here: And if their Writings have some Excellencies, which the elegant Composures of more learned Ages want, this also affords us a convincing Argument, that Mankind will, in something or other, be always improving; and that Men of working Heads, what Subject soever they handle, though they live in Times when they have none but barbarous Patterns to

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plying himself to this *Italian*, return'd with one of Flesh, to the Wonder and Satisfaction of all that knew him. As for this *Elisius Calentius*, from whom we have the first mention, that I can find, of any such Operation, he was Contemporary and Familiar with *Sannazarius*, and *Jov. Pontanus*, who mentions him; as does also *Lilius Gyraldus*, in his History of the Modern Poets, and tells us, agreeably enough, that he was Poor, Amorous, and a Poet; that he was born at *Amphracta*, in *Apulia*, but liv'd generally at *Naples*: His Works were printed about MDIII; and afterwards, his *Epistles*, among other select ones, were publish'd by *Gilb. Cognatus*, and printed by *Oporinus*, in MDLVIII. But I must not omit, among the rest, (what indeed is so notorious, that no Man, I suppose will deny it,) That all the sorts of *Amputations*, as Limbs, and Breasts, &c. were as familiarly practis'd among the Ancients, as any can pretend they are among us, if we had only the Authority of a Poet for it, *Immedicabile vulnus ense rescindendum est*.

The Art of *Bandage*, or *Rowling*, no mean or unnecessary, though neglected piece of *Surgery*, and upon which the *French* do so much value themselves, they knew so well, and had in such perfection, that we have not pretended to add much

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' to that excellent and useful Treatise which
 ' *Galen* hath expressly written upon that Sub-
 ' ject. And though the Variety of Instru-
 ' ments now in use may seem, in some mea-
 ' sure, to be justly challeng'd by the Mo-
 ' derns, every Man adding as his own Fan-
 ' cy suggested, and the Necessity required;
 ' yet by what are transmitted to us by the
 ' Ancients, 'tis notorious, that they were
 ' neither ignorant nor destitute of those
 ' which were most necessary; and that they
 ' had variety of others too, may, by what
 ' we see describ'd by *Oribasius* and others,
 ' and are at this day made use of, more ea-
 ' sily be imagin'd than prov'd, but seems
 ' highly probable.

' As for Topical Medicines, most certain
 ' it is that we are oblig'd to them, for in-
 ' structing us in the Nature and Proper-
 ' ties of almost all those of which we do
 ' at this day form our Applications; some
 ' few excepted, the Productions of Modern
 ' Chymistry, in this or the preceding Cen-
 ' tury.

' And as for general Methods of Cure,
 ' many of them have been so excellently
 ' well handled by the Ancients, (to in-
 ' stance only in Wounds of the Head) that
 ' several of the Moderns who have written
 ' most judiciously upon them, have been
 ' of Opinion, that they could not serve
 ' and oblige Posterity better, than by Com-
 ' ment-

menting upon that admirable Book of *Hippocrates* upon the same Subject.

That which without Injury to the Ancients, or Vanity in our Selves, may be justly said, is, That the publishing Observations after that Method which some of the Moderns have done, is that wherein we must be allowed infinitely to have exceeded them ; and is vastly of more Advantage to the Reader, than the perusal of tedious Systems are capable of being, two or three of which generally comprehending whatever is to be found in all the rest : But particular Cases, when judiciously and faithfully reported, (of which too few, I fear, even of the Moderns, are guilty,) *Et prodesse solent & delectare*, are diverting and instructive at once, the Reader more effectually adding other Men's Experience to his own.

But to insist upon every particular, and to pretend to demonstrate what hath been invented, discontinued, or lost in every Age, if it be to be done, requires a Person of greater Leisure, and infinitely more capable than my self. What I have said, is sufficient to shew, that it becomes us to speak of the Ancients with Respect and Civility at least, if it were only for this, That it was our Instruction, and the Benefit of Mankind in general, which induc'd them to take that Care, and to be

‘ at so much Expence of Time and Labour
 ‘ to communicate their Knowledge to the
 ‘ World: Not that we are implicitly to be
 ‘ determin’d by their Authority, or to sup-
 ‘ pose that they have not left room for suc-
 ‘ ceeding Ages to Invent, and to Improve
 ‘ all those Parts of *Surgery* wherein they
 ‘ appear either to have been mistaken or
 ‘ deficient. For my own part, I must
 ‘ confess, I do entirely concur with *Tho-*
 ‘ *mas Bartholine*, [*Epist. Med. Cent. 3.*] who
 ‘ very well understood the Advantages
 ‘ which the Moderns had, and was himself
 ‘ as solicitous for the Improvement of Know-
 ‘ ledge, as inquisitive into Nature, and as
 ‘ happy in his Discoveries, as any of those
 ‘ who imagine it a part of their Wit and
 ‘ Breeding, to ridicule and contemn the
 ‘ Ancients; *Pessimè studiis suis consulant* (says
 ‘ he) *qui ita recentiorum scriptis se immer-*
 ‘ *gunt, ut veteres vel negligent vel contem-*
 ‘ *nant, quum plerarumque rerum lux ex illis*
 ‘ *pendeat*: And in another place; *Ita sem-*
 ‘ *per recentiorum sententiis & opinionibus cal-*
 ‘ *culum adjeci, ut sua antiquitati reverentia*
 ‘ *servaretur, cui artis nostrae fundamenta de-*
 ‘ *bemus.*

C H A P. XXVII.

Of Ancient and Modern Natural Philosophy.

HAVING gone through with the most considerable Branches of *Natural* and *Mathematical Knowledge*, I am now to enquire into the Comparative Excellency of Ancient and Modern *Books of Philosophy*, thereby to see in which of them Nature, and its Operations, are explained best. Here I shall first enquire into the several *Methods of Philosophizing*; and afterwards, into the Intrinsic Worth of the Doctrines themselves. *Moderns* here are taken in a very strict sence. I shall mention none who have made any *Entries upon this noble Stage of Nature* (w) above LXXX Years (w) P. 44. ago, since the time of those first Flights of the Restorers of Learning, that are so exceedingly applauded by Sir *William Temple*. For *Natural Philosophy* was the last part of Knowledge which was cultivated with any particular Care, upon the Revival of Learning; though *Natural History*, which is a principal Ground-work, had been long before

fore encreasing, and a considerable Heap of Materials had been collected, in order to the Work.

As for *Modern Methods of Philosophizing*, when compared with the *Ancient*, I shall only observe these following Particulars. (1.) No Arguments are received as cogent, no Principles are allowed as current, amongst the celebrated Philosophers of the present Age, but what are in themselves intelligible; that so a Man may frame an Idea of them, of one sort or other. Matter and Motion, with their several Qualities, are only considered in Modern Solutions of Physical Problems. *Substantial*

(x) P. 46. *Forms, Occult Qualities, (x), Intentional Species, Idiosyncrasies, Sympathies and Antipathies of Things*, are exploded; not because they are Terms used by Ancient Philosophers, but because they are only empty Sounds, Words whereof no Man can form a certain and determinate Idea. (2.) Forming of Sects and Parties in Philosophy, that shall take their Denominations from, and think themselves obliged to stand by the Opinions of any particular Philosophers, is, in a manner, wholly laid aside. *Des Cartes* is not more believed upon his own Word, than *Aristotle*: Matter of Fact is the only thing appealed to; and Systems are little farther regarded, than as they are proper to instruct young Beginners, who must

must have a general Notion of the whole Work, before they can sufficiently comprehend any particular Part of it ; and who must be taught to reason by the Solutions of other Men, before they can be able to give Rational Solutions of their own : In which Case, a false Hypothesis, ingeniously contrived, may now and then do the Service of a true one. (3.) *Mathematics* are joined along with *Physiology*, not only as Helps to Men's Understandings, and Quickeners of their Parts, but as absolutely necessary to the comprehending of the Oeconomy of Nature, in all her Works. (4.) The *New Philosophers*, as they are commonly called, avoid making general Conclusions, till they have collected a great Number of Experiments or Observations upon the Thing in hand ; and, as new Light comes in, the old Hypotheses fall without any Noise or Stir. So that the Inferences that are now a-days made from any Enquiries into Natural Things, though perhaps they be set down in general Terms, yet are (as it were by Consent) received with this tacit Reserve, *As far as the Experiments or Observations already made, will warrant.*

How much the pursuing of these Four Things will enlarge *Natural Philosophy*, is easie to guess. I do not say, that none of these things were anciently minded ; but

only, that they were not then so generally put in practice. The great Men of Antiquity often exprest themselves in unintelligible Cant : They chiefly aim'd at being Heads of particular Sects : Few of their Natural Philosophers were great Mathematicians : And they did in general establish Hypotheses without a sufficient Fund of Experiments and Observations whereupon to build them. The *Corpuscularian Philosophy* is in all probability the oldest, and its Principles are those intelligible ones I just now commended. But its Foundations being very large, and requiring much Time, Cost, and Patience, to build any great Matters upon, it soon fell, before it appears to have been thoroughly understood. For it seems evident, that *Epicurus* minded little but the raising of a Sect, which might talk as plausibly as those of *Aristotle*, or *Plato*, since he despised all manner of Learning, even Mathematics themselves, and gloried in his having spun all his Thoughts out of his own Brain ; a good Argument of his Wit indeed, but a very ordinary one of that Skill in Nature which *Lucretius* extols in him, as often as he takes occasion to speak of him. The Ancient Physics look like a thing wholly of Ostentation and Pomp, otherwise I cannot understand why *Plato* should reprove *Eudoxus* and *Archytas*, for trying to make
their

their Skill in Geometry useful in Matters of Civil Life, by inventing of Instruments of public Advantage ; or think that those sublime Truths were debased, when the unlearned part of Mankind were made the better for them. And therefore, as *Plutarch* complains, in his *Life of Marcellus*, Mechanical Arts were despised by Geometers till *Archimedes's* Time : Now though this be particularly spoken there by *Plutarch*, of the Making of Instruments of Defense and Offense in War, yet it is equally applicable to all the Ancient Philosophy and Mathematics in general. The Old Philosophers seemed still to be afraid that the Common People should despise their Arts, if generally understood : This made them keep, for the most part, to those Studies which required few Hands and Mechanical Tools to compleat them : Which to any Man that has a right Notion of the Extent of a Natural Philosopher's Work, will appear absolutely necessary. Above all, the Ancients do not seem sufficiently to have understood the Connexion between Mathematical Proportions of Lines and Solids, in an abstracted Proposition, and in every Part of the Creation ; at least, in their Reasonings about the Causes of Natural Things, they did not take much Pains to shew it. When *Galen* was to give an Account of Vision, in his Books

(y) De
U. P. l. x.
c. 12, 13,
14.

Books (y) *de Ufu Partium*, because he had Occasion to use some few Geometrical Terms, as *Cone*, *Axis*, *Triangle*, and the like ; he makes a long Excuse, and tells a tedious Story of a Daemon that appear'd to him, and commanded him to write what he did ; and all this, lest the Physicians of that Age should think he Conjur'd, and so take a Prejudice against all he said. This shews, that in *Galen's* Time at least, there was little Correspondence between Mathematical and Physicall Sciences, and that Mankind did not believe there was so intimate a Relation between them as it is now generally known there is. Many a Man that cannot demonstrate any one single Proposition in *Euclid*, takes it now for granted, that Geometry is of infinite Use to a Philosopher ; and it is believed now upon Trust, because it is become an Axiom amongst the Learned in these Matters. And if it had been so received in *Galen's* Time, or by those more Ancient Authors whom *Galen* and his Contemporaries followed, or pretended at least to follow, as their Patterns ; such as *Hippocrates*, whom all Sides revered, *Herophilus*, *Erasistratus*, *Asclepiades*, and several more, there would have been no need of any Excuses for what he was doing ; since his Readers being accustomed to such sort of Reasonings, would either readily have understood them,

them, or acquiesced in them as legitimate Ways of Proof. If Three or Four Mathematical Terms were so affrightning, how would those learned Discourses of *Steno* and *Croone*, concerning Muscular Motion, have moved them? How much would they have been amazed at such minute Calculations of the Motive-strength of all the Muscles in the several general sorts of Animals, as require great Skill in Geometry, even to understand them, which are made by *Borellus*, in his Discourses of *the Motion of Animals*? It is not enough, in this Case, to quote a Saying or two out of some great Man amongst the Ancients; or to tell us, that *Plato* said, long ago, *That God Geometrizes in all his Works*; as long as no Man can produce one Ancient Essay upon any Part of Physiology, where Mathematical Ratiocinations were introduced to salve those *Phaenomena* of Natural Things, upon which it was possible to talk plausibly without their Help. At least, it is certain, That they contented themselves with general Theories, without entring into minute Disquisitions into the several Varieties of Things, as is evident in the two Cases already alledged, of *Vision* and *Muscular Motion*.

Now as this Method of Philosophizing laid down above, is right, so it is easie to prove, that it has been carefully followed
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by Modern Philosophers. My Lord *Bacon* was the first Great Man who took much pains to convince the World that they had hitherto been in a wrong Path, and that Nature her self, rather than her Secretaries, was to be addressed to by those who were desirous to know much of her Mind. Monsieur *Des Cartes*, who came soon after, did not perfectly tread in his Steps, since he was for doing too great a part of his Work in his Closet, concluding too soon, before he had made Experiments enough ; but then to a vast Genius he joined exquisite Skill in Geometry, and working upon Intelligible Principles in an Intelligible Manner, though he very often failed of one part of his End, namely, a right Explication of the *Phaenomena* of Nature ; yet by marrying Geometry and Physics together, he put the World in Hopes of a Masculine Off-spring in process of Time, though the first Productions should prove abortive. This was the state of Natural Philosophy, when those great Men who, after King *Charles II^d*'s Restoration, joined in a Body, called by that Prince himself, the *ROYAL SOCIETY*, went on with the Design ; they made it their Business to set their Members a work to collect a perfect History of Nature, in order to establish thereupon a Body of Physics. What has been done towards it by the Members of

of that Illustrious Body, will be evident to those who consider that *Boyle, Barrow, Newton, Huygens, Malpighius, Leeuwenhoek, Willughby, Willis*, and abundance more already named amongst the great Advancers of real Learning, have belonged to it : If it shall be thought too tedious an Undertaking, to examine all their Writings, Mr. *Boyle's Works*, Monsieur *Le Clerc's Physics*, any one good *System of the Cartesian Philosophy*, Monsieur *Robault's* for Instance, or to comprehend all under one, a Book intituled, *Philosophia Vetus & Nova ad Usum Scholae accommodata*, may be consulted, and then there will be no difficulty to determine of which Side the Verdict ought to be given ; in the last Book especially it is evident how very little the Ancients did in all Parts of Natural Philosophy, and what a great Compass it at present takes, since it makes the Comparison I all along appeal to.

Thus, it seems to me to be sufficiently plain, That the Ancients Knowledge in all Matters relating to *Mathematics* and *Physics*, was incomparably inferior to that of the Moderns. These are Subjects, many of them at least, which require great Intenseness of Thought, great Strength and Clearness of Imagination, even only to understand them ; how much more then to invent them ? The Ancient Orators, who spoke so great things in Praise of
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Eloquence, who made it so very hard a thing to be an Orator, had little or no Notion of the Difficulty of these Sciences; the *Romans* especially, who despised what they did not understand, and who did not without some Indignation learn of a People whom themselves had conquered. But if they could have conceived what a Force of Genius is required to invent such Propositions as are to be found in the Writings of their own Mathematicians, and of the Modern Geometers and Philosophers, they would soon have acknowledged that there was need of as great at least, if not greater Strength of Parts and Application to do very considerable things in these Sciences, as in their own admired Eloquence, which was never more artfully employed than in commending it self. The Panegyrics which they made upon Geometry, were rather Marks of their Pedantry, than of their Skill; *Plato* and *Pythagoras* admired them, and therefore they did so too, out of a blind Reverence to those great Names. Otherwise, amongst those numerous Commendations which are given to *Archimedes*, some would have been spent upon the many noble Theorems which he discovered, and not almost all upon the Engines wherewith he baffled *Marcellus* at the Siege of *Syracuse*. The Proposition, *That the Superficies of a Sphere is equal to the Area's of Four of its*

its greatest Circles, which is one of the most wonderful Inventions that was ever found in Geometry, shews him to have been a much greater Man, than all that is said of him by the *Roman* or *Greek* Historians. Had Experimental Philosophy been anciently brought upon the Stage, had Geometry been solemnly and generally applied to the Mechanism of Nature, and not solely made use of to instruct Men in the Art of Reasoning, and even that too, not very frequently neither, the Moderns would not have had so great Reason to boast as now they have : For these are things which come under Ocular Demonstration, which do not depend upon the Fancies of Men for their Approbation, as Oratory and Poetry often do. So that one may not only in general say, that the Ancients are out-done by the Moderns in these Matters, but also assign most of the Particulars, and determine the Proportion wherein and how far they have been exceeded, and shew the several Steps whereby this sort of Learning has from Age to Age received Improvement. This ends Disputes and satisfies the Understanding at once.

 C H A P. XXVIII.

*Of the Philological Learning of the
Moderns.*

Hitherto, in the main, I please my self, that there cannot be much said against what I have asserted, though I have all along taken care not to speak too positively, where I found that it was not an easie thing to vindicate every Proposition without entring into a Controversie, which would bear plausible things on both Sides, and so might be run out into a multitude of Words, which in Matters of this kind are very tiresome. But there are other Parts of Learning still behind, where the bare offering to compare the Moderns to the Ancients, may seem a Paradox ; where the subject Matter is entirely ancient, and is chiefly, if not altogether contained in Books that were written before the Ancient Learning suffered much Decay.

Under this Head *Philology* and *Divinity* may very properly be ranked. I place *Divinity* last, to avoid Repetition ; because what I have to say concerning Modern *Philology*, will strengthen many things that
may

eminently Favourers of Learned Men. I have mentioned my own Country last, that I might once more observe, that it was a Prince of our own, who founded the *ROYAL SOCIETY*, (o) whose Studies, Writings and Productions, though they have not out-shined or eclipsed the *Lycæum* of Plato, the *Academy* of Aristotle, the *Stoa* of Zeno, or the *Garden* of Epicurus, because they were neither written at the same Time, nor, for the most part, upon the same Subjects; yet will always help to keep alive the Memory of that Prince, who incorporated them into a Body, that so they might the easier do that by their Joint-Labours, which singly would have been, in a manner, impossible to be effected. (o) Pag. 57.

The last of Sir *William Temple's* Reasons of the great Decay of Modern Learning (p) is *Pedantry*; the urging of which is an evident Argument, that his Discourse is levelled against Learning, not as it stands now, but as it was Fifty or Sixty Years ago. For the new Philosophy has introduced so great a Correspondence between Men of Learning and Men of Business; which has also been en-creased

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creased by other Accidents amongst the Masters of other learned Professions, that that *Pedantry* which formerly was almost universal, is now in a great Measure dis-used; especially, amongst the young Men, who are taught in the Universities to laugh at that frequent Citation of Scraps of Latin, in common Discourse, or upon Arguments that do not require it; and that nauseous Ostentation of Reading, and Scholarship in publick Companies, which formerly was so much in Fashion. Affecting to write politely in Modern Languages, especially the *French* and ours, has also helped very much to lessen it, because it has enabled Abundance of Men who want Academical Education to talk plausibly, and some exactly, upon very many learned Subjects. This also, has made Writers habitually careful to avoid those Impertinences which they know would be taken notice of and ridiculed; and it is probable, that a careful perusal of the fine new *French* Books, which of late Years have been greedily sought after by the politer sort of Gentlemen and Scholars, may in this particular, have done Abundance of good. By this means, and by

by the Help also of some other concurrent Causes, those who were not learned themselves being able to maintain Disputes with those that were, forced them to talk more warily, and brought them by little and little to be out of Countenance at that vain thrusting of their Learning into every thing, which before had been but too visible.

Conclusion.

THis seems to me to be the present State of Learning, as it may be compared with what it was in Former Ages: Whether Knowledge will improve in the next Age, proportionably, as it has done in this, is a Question not easily decided. It depends upon a great many Circumstances; which singly, will be ineffectual, and, which no Man can now be assured, will ever meet. There seems Reason indeed, to fear, that it may decay, both because ancient Learning is too much studied in Modern Books, and taken upon trust by Modern Writers, who are not enough acquainted with Antiquity to correct their own mistakes; and because Natural and Mathematical Knowledge, wherein chiefly the Moderns are to be studied as Originals, begin to be neglected by the Generality of those who would set up for Scholars. For the Humour of the Age,
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as to those things, is visibly altered from what it was Twenty or Thirty Years ago: So that though the *ROYAL SOCIETY* has weathered the rude Attacks of such sort of Adversaries as *Stubbe*, who endeavoured to have it thought, That Studying of Natural Philosophy and Mathematicks, was a ready Method to introduce Scepticism at least, if not Atheism into the World: Yet the sly Insinuations of the *Men of Wit*, That no great things have ever, or are ever like to be performed by the *Men of Gresham*, and, That every Man whom they call a *Virtuoso*, must needs be a *Sir Nicholas Gim-crack*, have so far taken off the Edge of those who have opulent Fortunes, and a Love to Learning, that Physiological Studies begin to be contracted amongst Physicians and Mechanicks. The Truth is, one must spend a good deal of Time and Pains, of Industry and Attention, before he will be able thoroughly to relish them: And those who do not, rarely know their Worth, and consequently do very seldom pass a right Judgment upon them: For which Reason, when the present Sett of Philosophers are gone off, it is a great Question, whether a
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new one will succeed, that may equal them. Their Writings, however, will be preserved, and as our Age has raised a nobler Monument to the Memory of *Archimedes* and *Diophantus*, of *Hippocrates* and *Aristotle*, of *Herophilus* and *Galen*, by improving of their Inventions, than had been raised for a Thousand Years before; so some future Age, though, perhaps, not the next, and in a Country, now possibly little thought of, may do that which our great Men would be glad to see done; that is to say, they may raise real Knowledge, upon the Foundations laid in this our Age, to the utmost possible Perfection, to which it can be brought by mortal Men in this imperfect State.

But this is what one would gladly hope should be reserved for his own Posterity, and his own Country; how it may be reserved is obvious: It must be by joining Ancient and Modern Learning together, and by studying each as Originals, in those things wherein they severally do most excel; by that means few Mistakes will be committed, the World will soon see what remains unfinish'd, and Men will furnish themselves

selves with fitting Methods to compleat it: And by doing Justice to every Side, they will have Reason to expect, that those that come after them will do the same Justice to them, whenever they shall think fit to submit their Productions to publick Censure.

FINIS.

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